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TWO VOLUMES IN ONE.—VOL. I.

NEW YORK:
A. S. BARNES & CO., 51 JOHN-STREET.
CINCINNATI:—H. W. DERBY.
1854.

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PREFACE.

In presenting to the public a new Dictionary of Architecture, no apology, we imagine, will be required for the undertaking. Little need be said on the necessity of such a work, inasmuch as it is in reality the only one of the kind. Those which already exist on the subject, not to mention their expensive size, are rather *encyclopedias* of treatises on the different branches of science and art connected with architecture, than *dictionaries*, of the practice, and theory, and history, and description of the science of architecture, and architectural archæology; such works are intended to supersede separate treatises upon Geometry, Perspective, Trigonometry, and the Mechanical parts of architecture. Our book we wish to be of general utility to the professor and the amateur, and, indeed, to almost every general reader—to contain a large mass of material for general and constant reference, brought together from a multitude of sources, much of which, we believe, cannot otherwise be referred to without great labour and expense. In such a work, it is not to be wondered at, if some faults are to be found: the defects, however, we hope and trust, will be found to be but few, and not of any great importance, in comparison, at least, with the general utility of the whole.

It was first intended to insert brief biographies of eminent architects in the alphabetical dictionary. It was found, however, that by giving such biographical notices of all, the size of the book would be increased, without proportionally increasing its utility; and we, therefore, came to the determination of giving biographical notices of such only as were persons of very great note, and of giving at the end, complete tables of architects arranged in chronological order, and exhibiting at once their name, country, age, and works. To facilitate the reference to these Tables, an alphabetical Index of their names is added, and more particular accounts of British architects will be found in the Introduction.

In Appendix, No. II., we have given a Manual of Architectural Bibliography. In many of the articles of the Dictionary, we have referred to books on the subject, and sometimes given lists of them, but it was still considered very desirable that a more complete list of architectural works and writers should be given. The reader will, by means of this manual, and the Indices of names and subjects that follow it, when he has gained all the information that our book will give him on any subject, be able to refer to such books as will furnish him with more. This does not by any means pretend to contain a complete list of architectural books, but it contains nearly all of any importance.

Our third Appendix contains brief heads of Jurisprudence, as far as it is connected with architecture, which also, we trust, will not be found devoid of utility. Our principal authority, in the compilation of this part of the work, has been a useful little book by Mr. Elmes, on Architectural Jurisprudence, which we can with confidence recommend to such of our readers as may wish for more information on the subject.

NOTE.

Former editions of this work contained a large number of steel plates, which augmented the price beyond the means of many purchasers; they are therefore omitted in this edition.

INTRODUCTORY ESSAY

ON THE

PROGRESS OF ARCHITECTURE IN ENGLAND,

SINCE THE NORMAN CONQUEST.

The materials for a history of early English Architecture are very few, and are scattered in books and manuscripts to which it is difficult to many to gain access. If there were more, perhaps, from the rude state of the art in those ages, we should only find, that with what we know we may be sufficiently contented. Of the Architecture itself, as it is known from works that remain, numerous notices will be found in different articles of the following Dictionary: of the architects, some account will be given in the Appendix: we shall, therefore, here content ourselves in the early period, by arranging such matter as has been discovered in ancient documents relating to Architecture; and, as we approach nearer the present age, we shall embody in these notices some observations on the different styles that have prevailed in those modern times.[1] Two of the earliest documents relate to the reign of king John: the first, dated 1209, records the payment of ten marks to the architect Elyas, for repairing the palace at Westminster; the second relates to estimates made by one William Puintell, who was either an architect or a surveyor employed on the works at the Tower, (ad operationes Turris Londoniæ.) The interior apartments of the royal dwellings were at that time ornamented with painted wainscoting, as appears from an entry of the reign of Henry the Third, in 1233, ordering a chamber to be painted anew with such histories and pictures as had before adorned it, (quod cameram regis lambruscatam[2] de castro Winton. depingi faciat eisdem historiis et picturis quibus fuerit prius depicta.) A record of the same reign, mentioned by Stowe, gives directions for repairing the granary under the Tower, and all the leaden gutters, and for leading the whole thoroughly on that side, and for white-washing the chapel of St. John. The same record orders that three painted glass windows should be made in the same chapel. In Aubrey's Survey of Surrey, quoted by Walpole, he says, on the authority of Dugdale, that the first painted glass in England was done in the reign of king John. In the same chapel of St. John, another record, of the same time, mentions a marble font with handsome marble columns, (unum fontem marmoream cum columpnis marmoreis bene et decenter incisis.) A record of the twenty-first of Henry the Third, orders four pounds eleven shillings to be paid to Odo Aurifaber, for painting pictures in the king's chamber. A record of the twenty-eighth of the same reign, commands the sheriff of Kent to furnish and carry to Westminster, without delay, a hundred barge loads of grey stone, (100 navatas grisiæ petræ,) which might either come from a Kentish quarry, or be imported from the coast of France. A record of the forty-fifth year of the same reign, contains a curious memorandum of the sums expended on the king's buildings at Westminster.[3] From some other record, we learn that the salary of Master William of Florence, as surveyor of the works at Guildford, was sixpence a day.

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[1] It is extracted and abridged in a great part from Walpole's Anecdotes of Painting.

Master William, we see, was an Italian, and it is probable that it was no uncommon thing to employ Italian artists in England about this time. The crosses erected to the memory of queen Eleanor, Vertue supposed, with great probability, to have been built after the designs of Peter Cavalini, a Roman sculptor. Vertue also discovered that this person was the architect of the shrine of Edward the Confessor; and the following extract from Walpole will shew at once the arguments he makes use of, and the mode in which Italian artists came into England.

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[2] *Lambruscatam*, wainscoted, from the French *lambris*.

[3] Summa cust. operationum Westm. ab inceptione usque in die dominica post festum divi Michaelis anno regni regis Henrici xlv^{to}. Et cclx Libræ restant solvendæ pro stipendiis alborum cissorum et minutorum operariorum, et pro Franca petra et aliis emptionibus quæ non computantur in hac summo; xxix millia, occxlv *l.* xix *s.* viii *d.*

"The original Inscription on the tomb ran thus:—

Anno milleno Domini cum septuageno
Et bis centeno, cum completo quasi deno,
Hoc opus est factum, quod Petrus duxit in actum
Romanus civis: Homo, causam noscere si vis,
Rex fuit Henricus, sancti præsentis amicus.

"The words *Petrus duxit in actum—Romanus civis*, were discernible till very lately. Some old authors ascribe the erection of the shrine to Henry himself; others, to Richard de Ware the abbott elected in 1260. It is probable that both were concerned. The new abbot repaired to Rome immediately on his election, to receive consecration from Urban the Fourth. At that time, says Vasari, flourished there Peter Cavalini, a painter, and the inventor of Mosaic, who had performed several costly works in that city. About four years before the arrival of Abbot Ware, that is, in 1256, had been erected a splendid shrine for the martyrs, Simplicius and Faustina, at the expense of John James Capoccio and his wife, adorned with twisted columns, and inlaid with precious marbles exactly in the taste, though not in the precise form, of that of St. Edward. Nothing is more probable than that a rich abbot, either at his own expense, or to gratify the taste of his magnificent master, should engage a capital artist to return with him, and undertake the shrine of his master's patron saint, and the great patron of his own church. Weever says expressly, that the abbot brought back with him from Rome *workmen*, and rich porphyry stones, for Edward the Confessor's erectory; and for the pavement of the chapel. This abbot was lord treasurer till his death in 1283, and was buried on the north side of the great altar. Over him was anciently this epitaph, confirming the circumstances above mentioned,

Abbas Richardus de Warâ, qui requiescit
Hic, portat lapides, quos hic portavit ab Urbe.

"Vasari's silence on Cavalini's journey to England, ought to be no objection: he not only wrote some hundred years after the time, but confounds his own accounts so strangely, as to make Peter Cavalini scholar to Giotto, who was twenty years younger. If it may be imagined, that Richard Ware could not have interest enough to seduce so capital a workman from the service of the pope, it might still be accounted for by higher authority. Edward the First, returning from the Holy-land, was conducted by the king of Sicily to Rome, to visit Gregory the Tenth, who had been Edward's companion and friend in the holy war. An artful pope would certainly be glad to furnish a young king with artists, who would encourage him in raising shrines and temples. The monument of Henry the Third, erected by his son, is beautified in the same taste, with porphyry and mosaic: and the first brazen statue known to have been cast here, lies upon it. The old painting round the chapel of St. Edward, and those in a very beautiful and superior style, though much decayed, over the ragged regiment, Vertue ascribes to the same Cavalini."

During the reigns which followed that of Henry the Third, the arts were allowed to lie long entirely neglected. In the reign of Henry the Fourth was painted the fine east window in the Cathedral of York. John Thornton, glazier, of Coventry, who contracted for it, was to receive for his own work four shillings a week, and to finish the whole in less than three years. Another indenture of 1338, for glazing some of the west windows, stipulates, that the workman should have sixpence a foot for white glass, and twelve-pence for coloured.

The accession of Henry the Eighth in 1509, brought along with it the establishment of the arts. Till the end of the reign of this king, from the decline of the heavy Saxon and Norman, the pointed Gothic was almost the only style in use in English buildings. The style differed much in its characteristics from the styles which had flourished in Greece and Rome, but it was in its particular kind strikingly beautiful. It is difficult for the noblest Grecian temple to convey half so many impressions to the mind, as does a cathedral of the best Gothic taste—a proof of skill in the architects, and of address in the priests, who erected them. The latter exhausted their knowledge of the passions in composing edifices, whose pomp, mechanism, vaults, tombs, painted windows, gloom, and perspectives, infused such sensations of romantic devotion; and they were happy in finding artists capable of executing such machinery. One must have taste, to be sensible of the beauties of Grecian architecture; one only wants passions, to feel Gothic. In St. Peter's, one is convinced that it was built by great princes. In Westminster Abbey, one thinks not of the builder; the religion of the place makes the first impression; and, though stripped of its altars and shrines, it is nearer converting one to popery, than all the regular pageantry of Roman domes. Gothic churches infuse superstition; Grecian, admiration. The papal see amassed its wealth by Gothic cathedrals, and displays it in Grecian temples. Inigo Jones, Sir Christopher Wren, and Kent, who certainly understood beauty, blundered into the heaviest and clumsiest compositions, whenever they aimed at imitations of the Gothic. Walpole, in speaking of the architects of his own time, observes—"Considering how scrupulously our architects confine themselves to antique precedent, perhaps some deviations into Gothic may a little relieve them from that servile imitation. I mean, that they should study both tastes, not blend them: that they should dare to invent in the one, since they will hazard nothing in the other. When they have built a pediment, and portico, the sibyl's circular temple, and tacked the wings to a house by a colonnade, they seem *au bout de leur Latin*. If half a dozen mansions were all that remained of old Rome, instead of half a dozen temples, I do not doubt but our churches would resemble the private houses of Roman citizens. Our buildings must be as Vitruvian, as writings in the days of Erasmus were obliged to be Ciceronian."

Towards the end of the reign of Henry the Eighth, the Grecian or Roman style was introduced. "It was first plastered upon Gothic, and made a barbarous mixture. Regular columns, with ornaments neither Grecian nor Gothic, and half embroidered with foliage, were crammed over frontispieces, façades, and chimneys, and lost all grace by wanting simplicity. This mongrel species lasted till late in the reign of James the First.

"The beginning of reformation in building seems owing to Holbein. His porch at Wilton, though purer than the works of his successors, is of this bastard sort; but the ornaments and proportions are graceful and well chosen. I have seen of his drawings two in the same style. Where he acquired this taste, is difficult to say; probably it was adopted from his acquaintance with his fellow-labourers at court. Henry had actually an Italian architect in his service, to whom I should without scruple assign the introduction of regular architecture, if it was clear that he arrived here so early as Holbein. He was called John of Padua, and his very office seems to intimate something novel in his practice. He was called *Devizer of his majesty's buildings*." No particular work of John of Padua can be mentioned: Holmby house was one of our earliest productions in regular architecture, but its date was 1583, and it could not, therefore, be well ascribed to John of Padua. Several other specimens of the same style of building are mentioned.

In the reign of Edward the Sixth, architecture preserved the same footing which it had acquired during the preceding year. Somerset house was built on the site of Chester inn, where the ancient poet Occleve formerly lived. The style is a compound of Grecian and Gothic, and as the pension to John of Padua was renewed in the third year of this reign, we may suppose that he owed it to the protector, and that he was the architect of his palace. Longleat, begun in 1567, was in the same style as Somerset house, and was built by Sir John Thynne, a principal officer to the protector.

In Elizabeth's reign, several names of architects occur. John Shute styles himself, "paynter and architecte," in a folio book published by him in 1563, called "The Just and Chief Groundes of Architecture, used in all the auncient and famous monyments, with a farther and more ample discourse uppon the same, than hitherto hath been set out by any other." The figures are in a better style than ordinary. In his dedication to the queen, he says, that he had been sent into Italy in 1550, by the duke of Northumberland, who maintained him there in his studies under the best architects. Stowe also mentions one Master Stickles, *an excellent architect*, who in 1596, built for a trial a furnace that might be taken to pieces. Robert Adams, the surveyor of the queen's buildings, seems to have been a man of abilities. He was buried in an aisle on the north side of Greenwich church, with this inscription.

> "Egregio viro, Roberto Adams, operum regiorum supervisori, architecturæ peritissimo, ob. 1595. Simon Basil, operationum regiorum contra rotulator hoc posuit monumentum, 1601."

The eastern side of Caius College, Cambridge, in which are the *portæ virtutis et sapientiæ* was built in 1566 and 1567. These are joined by two long walls to the *porta humilitatis*, and in these are two little Doric frontispieces, which shew the Roman architecture reviving, with little columns and pilasters, quite unproportioned to the building which they were intended to adorn. The gate of honour cost £128. 9s. 5d. The architect was Theodore Havens. In the college is an old picture of a man in a flashed doublet, with dark curled hair and beard, holding a pair of compasses, which appears to represent Theodore Havens himself. In the gallery of Emmanuel college, among other old pictures, is one with the following inscription, recording an architect of the same age.

> "Effigiès Rodulfi Simons architecti suâ ætate peritissimi, qui (præter plurima ædificia ab eo præclarè facta) duo collegia, Emanuelis hoc, Sidneii illud, extruxit integrè: magnam etiam partem Trinitatis reconcinnavit amplissime."

On the decline of the Gothic style, the ideas of grandeur seem to have been confined to what was spacious. The palaces erected during the reign of Elizabeth, by Elizabeth of Hardwicke, the countess of Shrewsbury, were in this style: "The apartments," Walpole says, "are lofty and enormous, and they knew not how to furnish them: pictures, had they had good ones, would be lost in chambers of such height; tapestry, their chief moveable, was not commonly perfect enough to be real magnificence. Fretted ceilings, graceful mouldings of windows, and painted glass, the ornaments of the preceding age, were fallen into disuse. Immense lights, composed of bad glass in diamond panes, cast an air of poverty on their most costly apartments. That at Hardwicke, still preserved as it was furnished for the reception and imprisonment of the queen of Scots, is a curious picture of that age and style. Nothing can exceed the expense in the bed of state, in the hangings of the same chamber, and of the coverings for the tables. The first is cloth of gold, cloth of silver, velvets of different colours, lace, fringes, and embroidery. The hangings consist of figures, large as life, representing the virtues and vices, embroidered on grounds of white and black velvet. The cloths to cast over the tables are embroidered, and embossed with gold, on velvets and damask. The only moveables of any taste are the cabinets and tables themselves, carved in oak. The chimneys are wide enough for a hall or kitchen, and over the arras are friezes of many feet deep, with miserable relievos in stucco representing huntings. There, and in all the great mansions of that age, is a gallery, remarkable only for its extent. That at Hardwicke is of sixty yards."

During the reign of James the First, the arts did not meet with much encouragement. Edward Jansen, supposed to be a Fleming, was engaged in many great works, among which were Audley End, near Walden in Essex, and the greater part of Northumberland house. The former was an immense pile of building, its rooms large, though not proportionally lofty, with a gallery of immense extent. The frontispiece of Northumberland house, Vertue discovered to be the work of Gerard Christmas, an architect of the same reign, who made the design for Aldersgate, and cut the bas-relief, of James the First on horseback, on it. John Smithson was an architect employed by the earls of Newcastle; he built Welbeck in 1604, the riding-house there in 1623, as appeared by his name over the gate, and the stables in 1625. When William Cavendish, earl of Newcastle, proposed to repair and make great additions to Bolsover-castle, Smithson went to Italy to collect designs, and from them, Walpole supposes, "the noble apartment erected by that earl (and afterwards duke,) and lately pulled down, was completed." Smithson died in 1648.[4] His son was also a man of some skill in architecture. Stephen Harrison, who calls himself, "joyner and architect," invented the triumphal arches erected in London for the reception of James the First.

The metropolis, during the reign of James, increased rapidly in extent. Elizabeth had issued several rigid proclamations against the increase of new buildings in the city; but they had produced little effect. In 1605, which was the second year of his reign, James issued a similar proclamation, forbidding all manner of building within the city, and a circuit of one mile thereof. It commanded also that all persons henceforward should build all their fore-fronts and windows, either of brick or stone; as well for decency, as by reason all great and well-grown woods were much spent and wasted, so that timber for shipping became scarce." As this proclamation also was ineffective, another was issued to the same purport in 1607, and some offenders were censured in the star-chamber, for building contrary to its tenor. Another edict, issued in 1614, required the commissioners to proceed with all possible strictness against every offender, and from this time we may date the reformation of domestic architecture in London. The first house of note erected conformably to this proclamation was built for colonel Cecil in the Strand. Next, one was built in the city, near Draper's hall, Throgmorton-street; and another for an opulent goldsmith, opposite Sadler's hall in the Cheapside. A leather-seller in St. Paul's churchyard had constructed his dwelling, near the north gate, of timber, and was compelled to take it down, and rebuild it in the prevailing fashion.[5]

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[4] Smithson's epitaph, in the chancel of Bolsover church, is as follows:

"Reader, beneath this plain stone buried lies
Smithson's remainder of mortality;
Whose skill in architecture did deserve
A fairer tomb his memory to preserve
But since his nobler works of piety
To God, his justice and his charity,
Are gone to heaven, a building to prepare
Not made with hands, his friends contented are.
He here shall rest in hope, 'till th' world shall burn.
And intermingle ashes with his urn.

Ob. Decemb. 27, 1648."

Towards the end of this reign, architecture was undergoing a great change for the better. The description of a palace which has been recommended by the great and accomplished Bacon, exhibits the same style which was so successfully cultivated by Inigo Jones and Sir Henry Wotton.[6] The description given by Bacon may be compared with the design for the new palace at Whitehall, by Inigo Jones. The "Elements of Architecture," by Sir Henry Wotton, contain at once the soundest doctrines of practice, and the purest ideas of taste.

The great ornament of the reign of the second Charles, was Inigo Jones. Walpole has given his history, as a genius, in a few words. 'Vitruvius drew up his grammar; Palladio shewed him the practice; Rome displayed a theatre worthy of his emulation; and king Charles was ready to encourage, employ, and reward his talents." Many of his designs may be seen in Campbell's Vitruvius, and in Kent's edition of his works. Among the best are the banqueting house at Whitehall; the new quadrangle of St. John's college, Oxford; the church of St. Paul, with the piazza and arcade of Covent-garden; the chapel of Lincoln's Inn, and part of Lincoln's-inn-fields; the queen's chapel at St. James's; the fine villa of lord Pembroke at Wilton; Coleshill, in Berkshire; Cobham hall, in Kent; the Grange, in Hampshire; the queen's house at Greenwich; and the portico of old St. Paul's.[7] Horace Walpole observes, of the banqueting house at Whitehall, that it is "a small part of the pile designed for the palace of our kings; but so complete in itself, that it stands a model of the most pure and beautiful taste." "Several plates, " he says, " of the intended palace of Whitehall have been given; but, I believe, from no finished design. The four great sheets are evidently made up from general hints; nor ould such a source of invention and taste as the mind of Inigo, ever produce so much sameness. The whole fabric, however, was so glorious an idea, that one forgets for a moment, in the regret for its not being executed, the confirmation of our liberties obtained by a melancholy scene that passed before the windows of that very banqueting house."[8]

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[5] Stowe. [6] See his Essays.

[7] Lord Burlington, comparing this portico with the new one, observed sarcastically, 'When the Jews saw the second temple, they wept."

Another remarkable man in the service of Charles was Sir Balthazar Gerbier D'Ouvilly, of Antwerp, who was both architect and painter, though excellent in neither. He first rose to repute by the interest of the duke of Buckingham, and, after the death of that nobleman, still continued to keep his ground in the court. In one of his books, he himself says, that the king promised him the office of surveyor-general of the works, after the death of Inigo Jones. In 1662, he published a small discourse on magnificent buildings, dedicated to the king, in which he treats principally of solidity, convenience, and ornament, and glances at some errors of Inigo Jones in the banqueting house. He mentions a large room built by himself, near the water-gate, at York-stairs, and says, that the king expressed as much satisfaction with it as with the banqueting house. In this book, he proposes to the lords and commons to level the streets, Fleet-bridge and Cheapside, and erect a sumptuous gate at Temple-bar, of which he had presented a design to the king. His last book is a small manual entitled, "Counsel and Advice to all Builders," &c. London, 1663, which contains some curious things, particularly the prices of work and materials at that time. In one place he ridicules the heads of lions, which were creeping through the pilasters on the houses in Great Queen-street, built by Webb, the scholar of Inigo Jones. Gerbier gave designs for Hempstead-marshal, the seat of lord Craven, afterwards destroyed by fire, and died there while it was building. The foundation was laid in 1662.

The early part of the reign of the first Charles was favourable to the progress of art. But this progress was stopped by the civil contentions which followed. The arts were in a manner expelled from society. That had enjoyed too much of the favour of the king, to share that of the people who had been oppressed by him. At the restoration, however, they returned with the royal family, and re-occupied their former place among the pleasures of society.

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[8] The fee of Inigo Jones, as surveyor, was eight shillings and fourpence per day, with an allowance of forty-six pounds a year for house-rent, besides a clerk, and incidental expenses. What greater rewards he had, are not on record.

Walpole has observed, that "the restoration of royalty brought back the arts, not taste." The king was, indeed, rather a lover of magnificence than of elegance, and true taste was made to give way to extravagance and show. Architecture was patronized, and, though the general taste was corrupted by imitations from the French, yet this reign produced Sir Christopher Wren.

John Webb, a scholar of Inigo Jones, built the seat of lord Mountfort, at Horseheath, in Cambridgeshire, and added the portico to the Vine, in Hampshire, for Chaloner Chute, speaker to Richard Cromwell's parliament. He also built Ambresbury, in Wiltshire, from the designs of his master, Inigo Jones.[1] He built, also, according to Gerbier, the large buildings in Queen-street, Lincoln's-inn-fields. Contemporary with Webb, lived captain William Winde, a native of Berghen-op-Zoom, and a scholar of Gerbier. He built a house for the duke of Newcastle in Lincoln's-inn-fields, the house at Cliefden, Coomb-abbey, for lord Craven, and finished Hempstead-marshal, which had been begun by Gerbier. The architect of Nottingham castle was a person of the name of Marsh, who also designed the additional buildings at Bolsover. The building of Montagu house, now the British museum, was conducted by Monsieur Pouget, a French architect, in 1678, according to Walpole.

"A variety of knowledge proclaims the universality, a multiplicity of works the abundance, St. Paul's the greatness," of the genius of Sir Christopher Wren. As an architect, Wren was more than equal to Jones, but was inferior to him in taste. It has been observed, that, perhaps, nothing of Wren's is equal in invention and taste to any thing of Jones's, and nothing of Jones's equals any thing of Wren's in scientific construction. His works in domestic architecture are much inferior to his public buildings, because they are more in accordance with the fashions of the time. His best productions of this class are the two fine mansions at Chichester, Marlborough House in Pall Mall, the house of Mr. Tegg the bookseller in Cheapside; a house in Great Russell Street, formerly occupied by Mr. Wren, and some others. Of his public buildings, St. Paul's alone is sufficient to perpetuate his memory.

Wren was for a long time the sole architect of note; but, towards the end of his life, a school of architects arose, and succeeded him. During the reign of William, the name of William Salman occurs, who was employed on several considerable works. He built Thoresby House in Nottinghamshire, which was afterwards burnt; Dynham House in Gloucestershire, (in 1698,) and Chatsworth. The design of the flight of steps leading from the hall to the apartments, at Chatsworth, was borrowed by Kent, in the erection of Holkham. The steeple of Warwick church, having been burnt, was rebuilt by Sir William Wilson.

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[1] Webb designed the frontispiece to Walton's Polyglott Bible, which consists of architecture and figures.

In the reign of queen Anne flourished Sir John Vanbrugh, whose reputation is greater as a poet than as an architect. He was the leading architect of his day, and his genius was bold, and sometimes picturesque, but at the same time wild and incongruous. He began Blenheim in 1705, in which work his builder was Edward Strong, one of the master masons of Sir Christopher Wren. His other principal works were—the church of St. John in Westminster, "a wonderful piece of absurdity;" Castle Howard in Yorkshire; Eastberry in Dorsetshire; King's Weston, near Bristol; Easton Neston in Northamptonshire; one front of Grimsthorp; two little castles at Greenwich, and the Opera House in the Haymarket. The following is the character which Walpole has sketched of Vanbrugh's style.

"What Pope said of his comedies, is much more applicable to his buildings:

How Van wants grace!

Grace! He wanted eyes, he wanted all ideas of proportion, convenience, propriety. He undertook vast designs, and composed heaps of littleness. The style of no age, no country, appears in his works; he broke through all rule, and compensated for it by no imagination. He seems to have hollowed quarries, rather than to have built houses; and should his edifices, as they seem formed to do, outlast all record, what architecture will posterity think was that of their ancestors? The laughers, his contemporaries, said, having been confined in the bastile, he had drawn his notions of buildings from that fortified dungeon. That a single man should have been capricious, should have wanted taste, is not extraordinary. That he should have been selected to raise a palace, built at the public expense for the hero of his country, surprises one. Whose thought it was to load every avenue to that palace with inscriptions, I do not know; altogether they form an edition of the acts of parliament, in stone. However partial the court was to Vanbrugh, every body was not so blind to his defects. Swift ridiculed both his own diminutive house at Whitehall, and the stupendous pile at Blenheim: of the first he says;

At length they in the rubbish spy
A thing resembling a goose pie.

And of the other;

That if his grace were not more skill'd in
The art of battering walls than building,
We might expect to see next year
A mouse-trap man chief engineer."

The names of Roberti and Bagotti appear also as architects during the reign of queen Anne.

Architectural taste appeared to be at its lowest ebb during the reign of the first George. Inigo Jones first revealed on our soil the beauties of antiquity, and established simplicity, harmony, and proportion. This did not last long, for the chaste beauties of this school expired with Wren, and gave place to a style whose characteristics verged into mere masses of masonry. Nicholas Hawksmoor was a pupil of Wren, and was, as early as the reign of Charles, supervisor of the palace at Westminster. He assisted Wren in conducting the works at St. Paul's until their conclusion, was deputy surveyor at the building of Chelsea college, and clerk of the works at Greenwich, in which post he was continued by William, Anne, and George the First, at Kensington, Whitehall, and St. James's. Under George the First, he was first surveyor of all the new churches, and of Westminster Abbey, after the death of Wren. His churches are St. Mary Woolnoth in Lombard Street; Christ Church in Spitalfields; St. George, Middlesex; St. Anne, Limehouse; and St. George, Bloomsbury. He also built part of All Souls College, Oxford; the two towers over the gateway of which are copies of his own steeple of St. Anne, Limehouse. He was associated with Vanbrugh in the works at Blenheim and Castle Howard. Among the best of his houses may be instanced Easton Neston in Northamptonshire.[1]

James Gibbs was born at Aberdeen in 1683, and pursued the study of architecture in Italy. In 1720, he became the most popular man in his profession. The knowledge of Gibbs was merely mechanical: the members of his works are correct, but the whole wants taste and grace in distribution and design. Among his churches are St. Martyn's; St. Mary's in the Strand; and a church at Derby. His works at Cambridge are the central pile of buildings at King's College, and the Senate-house. At Oxford, he was the author of the Ratcliffe Library; at the opening of which, he was complimented by the University with the degree of Master of Arts. The quadrangle of All Saints, though he was very inferior in Gothic architecture, is superior to the library, and possesses considerable grandeur, when seen through the gate that leads from the school. "The assemblage of buildings in that quarter," Walpole observes, "though no single one is beautiful, always struck me with singular pleasure, as it conveys such a vision of large edifices, unbroken by private houses, as the mind is apt to entertain of renowned cities that exist no longer." Gibbs died in 1754, on the fifth of August. In 1728, he published a large folio of his own designs.

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[1] Hawksmoor died March 25, 1736, aged nearly 70. He restored a defect in the minster of Beverley, by means of a machine of his own invention, of which a print wa published. He also repaired in a judicious manner the west end of Westminster Abbey and gave a design for the Ratcliffe Library, at Oxford.

Colin Campbell, who was surveyor of the works at Greenwich Hospital, and died in 1734, had more correctness than Gibbs, though he did not excel him in taste and imagination. His best designs are Wanstead, the Rolls, and Mereworth in Kent, which was copied from Palladio. John James was also an architect employed in the works at Greenwich. He built the church there, that of St. George in Hanover Square; the body of the church at Twickenham; and that of St. Luke, Middlesex. He also built the house for Sir Gregory Page, at Blackheath, of which the idea was taken from Houghton.

The reign of George the Second opens a new era in the history of the arts. During the first years of this reign, Gibbs and Campbell were still at the head of their profession; but it had begun to improve before they left it, and soon after resumed all its rights. Fine publications were made of the works of Palladio, Inigo Jones, and of the antique; men of genius arose to imitate them, and men of rank came forwards to patronize their labours. A Venetian, named Giacomo Leoni, settled in England, and published a fine edition of Palladio in 1742, and was employed in building several houses.

The two great patrons of architecture were Henry Herbert, earl of Pembroke, and Richard Boyle, earl of Burlington. The great restorer of architecture was William Kent. None exceeded the earl of Pembroke in purity of taste. Part of the works at Wilton, a lodge in Richmond Park, the house at Marble-hill, Twickenham, the Waterhouse in the park at Houghton—were all his own designs. He overlooked assiduously the construction of Westminster Bridge, by M. Labelye. The earl of Burlington was an enthusiastic admirer of Inigo Jones. He proved his attachment to the arts by contributing large sums to public works, and his own designs were peculiarly chaste and classic. He assisted Kent in publishing the designs for Whitehall, and gave a beautiful edition of the antique baths from the drawings of Palladio, whose papers he had procured at a great expense. The grand colonnade within the court of Burlington House, Piccaddily, is the work of lord Burlington, as are various works on his estate at Lonsborough in Yorkshire. His house at Chiswick, with all its defects, is a model of taste.[1] Other designs by this munificent nobleman were, the dormitory at Westminster school; the assembly-room at York; lord Harrington's seat at Petersham; the duke of Richmond's house at Whitehall; and general Wade's in Cork Street.[2]

William Kent was born in Yorkshire, and put apprentice to a coach-painter, but left his master without leave, and went to London, where his talents procured him patronage, which enabled him to visit Italy in 1710. On his return to England in 1719, lord Burlington gave him an apartment in his own house, and procured him employment in painting, in which branch of art his genius first distinguished him. This, however, was a misapplication of his genius, as it was a branch in which he least excelled. His taste for ornaments was excellent, and it became a general fashion to consult him in all designs of furniture, and even of plate, barges, &c. In architecture his taste is deservedly admired. His favourite work was the house at Holkham in Norfolk; and the great hall, with the flight of steps at the upper end, where he proposed to place a colossal statue of Jupiter, was indeed very noble. "Holkham," says Walpole, "has its faults, but they are Kent's faults." The designs of Holkham were published under another name. Kent did not succeed well in Gothic architecture, as may be seen in the King's-bench at Westminster, and the house of Mr. Pelham at Esher.

Ripley, who was born in Yorkshire, was employed on several considerable works during this reign, but was devoid of architectural taste, though he excelled most of his contemporaries in the mechanical part, and in the disposition of apartments and conveniencies. He built the Admiralty, and the house at Woolterton, which belonged to lord Walpole, which is characterized by Horace Walpole, as "one of the best houses of the size in England." The Admiralty is not, however, deserving of commendation: its screen was the work of Mr. Adam.

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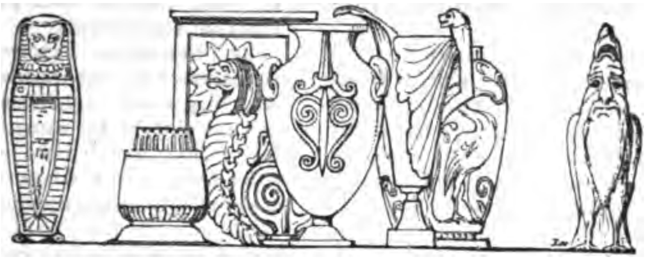
[1] The idea of this house was borrowed from a well-known villa of Palladio.

[2] The front of this latter was so beautiful, and the inside so ill-contrived, that lord Chesterfield said, "as the general could not live in it to his ease, he had better take a house over-against it, and look at it."

The elder Dance was a man of some genius, as may be seen in his church of Shoreditch, and his mansion-house was preferred to a design by Palladio, offered to the city by lord Burlington; but the preference is said to have been given to Dance's design, because Palladio was a papist, and was not a freeman. Perhaps, the most barbarous artist of this age, though not the least celebrated, was Batty Langley. Langley formed a kind of school, and his disciples were excellent workmen, but they were all carpenters. His Gothic style was a most barbarous invention of his own.

Towards the end of the reign of George the Second, architecture had again fallen to a low ebb. The best architects of that reign left no disciples; and they were succeeded by men of no account. The profession was abandoned to common surveyors and builders. George the Third, however, was a man of some taste, and, while prince of Wales, had studied the science under Chambers, who was then in the navy. Chambers, after his accession to the throne, became the royal architect, and his works have a chaste correctness of detail, of the best style of Italian art, though his taste was too much Roman, and impure. In his "Civil Architecture," which is a good book, he shews his bad taste by reviling the architecture of ancient Greece. The exclusive admiration of Roman architecture, however, soon passed away, and the art was now approaching to a greater degree of perfection than it had ever before reached in England. Its great ornaments were Adam, and Wyatt, and Milne. Wyatt was always tasteful and scientific. His Pantheon, and his other works, proved his skill in the architecture he had learnt in Italy. His imitations of the Gothic at Windsor, at Fonthill Abbey, and at Salisbury Cathedral, came little short of originals. Milne was the first of our countrymen who obtained a premium for art, at Rome: the design of his Blackfriar's Bridge was made before he had completed his studies. The encouragement now given to architecture, produced a multitude of skilful artists, such as Holland, the younger Dance, Soane, Wilkins, Harrison of Chester, Smirke, Gwilt, and Savage.



A DICTIONARY OF ARCHITECTURE.

AARON'S-ROD. *In decoration.* A rod with a serpent twined round it. The term is often used by workmen as synonymous with caduceus, or the wand which the ancients used as a symbol of the god Mercury.

Abaci. A word found in some translations of Vitruvius, which is supposed to mean pannels made in the stucco of walls, which are seen in many ancient classical buildings, and used as a decoration above the podium or dado.

Vitruvius directs that in winter eating-rooms, the cornices and ceilings are not to be minutely or delicately ornamented, because they are soon soiled by the smoke from the fire, and the soot produced by a number of lamps; and it is probably for the same reason that he adds, " In these apartments, the *abaci* above the podium are coloured *black*, and polished with yellow and red ornaments intermixed."

Galiani supposes *abaci* to be bricks cut from old plaster walls, and inserted into other (or new) work, to form a margin or relievo around some other ornament.

Abacot. *In decoration.* A coronet or cap of state, representing that which was anciently worn by the kings of England. See *Crown*.

Abacus. An instrument used by the ancients for casting up accounts, or performing arithmetical calculations.

By some authors it is derived from the Greek word *abax*, (a buffet, or table.) By others, from the Phœnician word *abak*, (dust or powder,) because this instrument was sometimes a square board or tablet, rubbed with wax, and strewed with sand or green dust, upon which mathematicians noted their calculations, and traced their diagrams;

and children formed the letters of the alphabet.

In furniture, abacus was the name of a *table* (or flap) without feet, fastened to the wall, used for holding vases and cups, and made so as to fold or hang down after use, *a sideboard* and a *buffet*, which were made of the precious woods covered with plates and ornaments of ivory or gold, a luxury derived by the Romans from the Asiatic Greeks, after their conquest of Asia. This was Cicero's splendid stand for the exhibition of his plate. Cato makes those of more homely materials part of the furniture of a Roman farmer's house. A *marble* abacus is described by Juvenal, (Sat. 13,) as being that used by a poor poet to place his water pitchers on.

Abacus. *In Greek and Roman architecture.* The upper member of the capital of a column, in the Greek doric, and a collection of members or mouldings, serving as a kind of crowning, in other orders. In the Greek and Roman examples it *covers* the ornaments or mouldings of the capitals.

In the corinthian order, the *abacus* is encurvated; which curving is called the *arch* of the abacus, and is commonly decorated with a rose or some other ornament in the centre, having the angles called the *horns* of the abacus cut off in the direction of the radius of the curve.

The upper member of the abacus of the corinthian capital is called, by some English writers, a boultine (or echinus;) the parallelopipedon under it, the fillet; and the third and undermost member, the plinth of the abacus.

Palladio states the proportion of the abacus to be one-third of the whole height of the tuscan and ionic capitals, and in the corinthian one-seventh.

The proportions, however, of this member in the various orders, vary much in different antique examples of the same order. Its general proportion, stated by the height of the entire order. is subject to similar irregularities.

Palladio calls the plinth above the echinus of the tuscan, *abacus*, or dye, or dado. Others restrict the term to the moulding or fillet under the cymatium of the capital of the Roman doric. In the ionic to the *ogee*, which is crowned with a fillet; or to a cima reversa with a fillet under, when placed in the same situation; and Scamozzi writes abacus for the *concave* moulding in the capital of the tuscan pedestal.

The *bowls* mentioned in the Book of Kings, were the circular parts of the doric capitals, and which, in the columns at Pæstum, have a great resemblance to bowls or cups, called by the Italians Tazze. The French style this member, in the capital of doric columns, the *vase de chapiteau.*

In all the doric buildings of Greece (except one or two) and its Asiatic colonies, it is a parallelopipedon with the horizontal sides, squares, and the vertical faces, rectangles.

In some Egyptian buildings it is a square block having the same dimensions on its side as the diameter of the pillar; in others it recedes, and then assumes the appearance of a cube interposed between the capital and the soffet of the architrave.

According to Vitruvius, the abacus was originally intended to represent a tile covering, a *basket*, or *vase*. And it is probably more correct, with a reference to this origin, to limit its use to the crowning of the corinthian capital; or to the coverings of baskets represented as borne on the heads of Caryatidæ, &c.

The abacus, according to an ingenious modern author, was the *primitive capital.* If we seek for its prototype in what have been considered to be the earliest buildings, in those countries abounding with timber, it appears as a square block, or plate of wood, inserted between the trunk of a tree serving for a column, and supporting another piece of timber employed as an architrave, as well for the purpose of steadying the one, as for fixing the other. The wooden abacus was at first very thick, and had a considerable projection, as may be observed in the capitals of many existing classical buildings, thus faithfully preserving in their forms the history of their origin. In the course of improvement, the under edge of the abacus was chamfered, to unite it more agreeably with the shaft; this assumed by degrees the curve form, and in receiving other modifications, it was still further assimilated to the shaft by having its horizontal section made a circle concentric to that of the column; the abacus then formed only a *part* of the capital.

If, instead of seeking for the origin of its introduction among buildings in those countries where writers are agreed that the primitive habitations of man must have been constructed of wood, it is sought for in those regions where, from a scarcity of timber and an abundance of stone, it is probable that the first habitations were erected of the latter material, the abacus will be used for a similar purpose, and assume the same form as in wooden structures. In Egyptian buildings, acknowledged to be of the most remote antiquity, the abacus is a single cube of stone inserted between the column and its architrave. In other examples, it consists of two and three parallelopipedons increasing in size, and evidently for the purpose of giving a better bed to the stones of the architrave, and adding to their strength by diminishing the length of their bearings. The abacus may thus be considered as a member essential both to the real and apparent stability of an order, and one of those inventions which have been used by man in every country and stage of civilisation.

The suppression of the abacus in some modern examples of the *leaved capital,* and the practice of forming that of the doric of an echinus only, may be considered to arise as well from ignorance of the first principles of construction, as a barbarous taste. The Chinese practice (who often employ wooden columns without capitals or abacus) is greatly to be preferred, for if we are forced to renounce the abacus, we should like them also abandon the use of the capital. See *Capital, Column, Order.* (See Supplement.)

Abaft, (*Abaftan,* Sax. behind.) *In naval architecture.* The hinder part of a ship, or all those parts both within or without, which lie towards the stern—used in opposition to afore—as a preposition, it signifies further aft, or nearer the stern.

Abascíscus. Is sometimes used as synonymous with Abacus. It is more correctly applied as a square compartment, enclosing a part, or the entire pattern or design of mosaic pavements.

Abate, Nicolas, an Italian architect and painter, born at Modena, in 1512, is generally considered as one of the best scholars of Begarelli; he travelled to France, and was employed in decorating with paintings some of the apartments of the palace of Fontainbleau. His style and colour nearly approached to those of Raffaelle: he was patronised by Francis I. and his successors, in whose service he remained until his death, which took place at a very advanced age, at Paris.

His most celebrated architectural works are the old chateau of Meudon, built from his designs, for the cardinal de Lorraine; and the tomb of Francis I., at St. Deny's.

ABATON. (*Abatos*, Gr.) An inaccessible, or impassable place, from a building at Rhodes, which no one was permitted to enter. Vitruvius thus relates the origin of its erection. "Mausolus, the most potent king of Halicarnassus, having observed Halicarnassus to be a place fortified by nature, well adapted for commerce, and having a commodious harbour, he there established his residence. This place is in the form of a theatre; the forum is situated at the bottom, near the port. At the top, in the middle of the curve, is formed an area, or square, of ample dimensions, in the midst of which stands the mausoleum, a building so excellent, that it is numbered among the seven wonders of the world. In the middle of the citadel, above, is the temple of Mars, having the colossal statue, which they call acrolithon, made by the hand of the noble Telochares, or, as some think, by Timotheus. The temple of Venus and Mercury is at the extremity of the right horn of the curve, near the fountain of Salmacis. As the temple of Venus and the above-mentioned fountain stand on the right horn, so on the left stands the royal palace which king Mausolus there judiciously situated. From its right side it commands a view of the forum, the port, and the whole compass of the city; on its left there is a secret port, so concealed by the mountains, that none can see or know what is there transacted, and the king himself could from his palace privately give his commands to his seamen and soldiers. After the death of Mausolus, when his wife Arthemisia reigned, the Rhodians, filled with indignation that all the cities of Caria should be governed by a woman, despatched a powerful fleet to take possession of the kingdom. Arthemisia hearing this, prepared a private squadron, well furnished with mariners and soldiers, and concealed them in this secret port, ordering the rest of the citizens to guard the walls. When the pompous fleet of the Rhodians appeared before the greater port, she commanded those who guarded the walls to seem to give them encouragement, and pretend that they would surrender the town. The deluded Rhodians having entered within the walls and left their navy weakly defended, Arthemisia unexpectedly opened a canal that had a communication with the sea, brought the squadron out of the secret port into the greater, and the Rhodian fleet being abandoned by the mariners and soldiers, and left defenceless, she drew it off to sea. The Rhodians having, therefore, no place of retreat, and being surrounded on all sides, were slain in the above-mentioned forum. Arthemisia then embarked her rowers and mariners in the Rhodian vessels, and ordered them to sail to Rhodes: the Rhodians seeing their vessels approach decorated with laurel, believed their fellow-citizens were returned victorious, and received the enemy. By this stratagem Arthemisia surprised Rhodes, slew the principal men, and then raised a trophy of her victory in the midst of the city, making two statues of brass, one representing herself, and the other the city of Rhodes held by her in subjection.

"In after-times, the Rhodians (as their religion forbade the removal of a consecrated monument) erected a high wall around it in the Greek manner, that the trophy might not be seen, and ordered it to be called *Abaton*."

Abbattis, Abatis, Abattis, Fr. *In military architecture*. A temporary defensive work of timber. It is usually formed of a great number of trees placed in a given alignment, with all their branches pointing outwards, and their trunks inwards. To strengthen the abattis, an earthen parapet and banquette for infantry is sometimes constructed in the rear of the trees, a part of which may be buried in the parapet to increase the solidity of the defence. When an abattis is constructed in a ditch, the trunks of the trees composing it may be placed some feet in the ground, like palisades, and the general line of the whole may incline outwards at an angle of about forty-five degrees, instead of having the described horizontal position.

Abattis is considered, among military architects, to be an effectual defence against an attack of infantry; it may, however, be greatly injured, and in a short time rendered unserviceable, by a fire of artillery. On this account, when it is employed to strengthen earthen works, it is usually placed in a dry ditch, or in other situations affording shelter from direct cannon shot.

It is a very useful work on most occasions, when trees are at hand, especially in sudden emergencies, and has been used with great success by the ablest commanders in all ages and nations. Athough it is more commonly used in temporary military works, it is often applied with great propriety to improve the defences, or to remedy the existing defects of permanent fortifications.

Abbey or Abby. A building appropriated for the habitation of a religious community, under the government of an abbot or an abbess

Abbeys were often of great extent, and, being constructed for a large domestic society, contained a variety of buildings adapted for religious observances,—the government of the establishment —for transacting the secular affairs of the body, and for the general purposes of habitation.

The *church* was an object of considerable importance, and was generally magnificent (comparatively) in dimension, and splendid in its decorations. The *refectory* was a large hall where the monks or nuns dined; and the *misericord*, among other uses, served them as a sort of neutral ground, where they indulged themselves in eating that food which they were forbidden by their rules to eat at certain times in the refectory. The *infirmary* was fitted for the separation and accommodation of the sick. The *guest-hall* for the entertainment and reception of strangers visiting the abbey. The *parlour* or *locutory*, where the fraternity assembled at stated times for conversation. The meetings appointed by the peculiar rule of the order for its government or discipline, were held in the *chapter*. The *dormitory* held the beds of the monks; or designated the range of cells in which they were placed. The *almonry*, a storehouse near the church or abbey-gate, in which the alms of the abbey were distributed. A *library*, and a *museum* adjoining. In the *writing-room*, books were copied for the use or profit of the society—*studies* furnished with presses and cabinets—*prison* for the refractory—*cells* for penance, and others for recreation. The *sanctuary* was rather a precinct than a building, in which, under certain conditions, an offender was safe from the operation of the law.—*Granges* or farm buildings, and *abbatial* residences, —*schools* for the instruction of youth, with separate accommodations for the scholars. *Song-school*, where the boys were instructed in singing. The *common-house*, a large room with a fire in it, for the monks to warm themselves at; no other fire being allowed except in the apartments inhabited by the abbot and some of the higher officers. A *mint* for coining, and a room called an *exchequer*, with a large square table for making calculations. The abbey had a *churchyard*, or burying-ground, for the interment of its members. And the abbey *garden* was as proverbial for its high state of cultivation, and the fine quality of its produce, as the *kitchen* was for its ample dimension and conveniences for the preparation in abundance of those viands which, it is said, "it delights the stomach to honour." The *bakehouse* was in its neighbourhood. In the *sacristy* the garments and ceimelia of the church were deposited, the monk's garments being kept in the *vestiaria*, or wardrobe. Many of the ordinary duties of the monks were performed in the *cloisters*, and it was here they delivered their lectures. For the various peculiarities in the arrangements and fitting up of these parts of monastic establishments, see the several words and their references, in their alphabetical order.

Abbuttals, Abuttals. The boundings or boundaries of a piece of land, expressing on what other lands, streets, rivers, or roads, &c., the several sides or extremes terminate.

Abele-tree. A species of white poplar, bearing a larger leaf, a finer grain, and being a quicker grower than the *wild abele*-tree or common white poplar. The leaves are divided into three, four, or five lobes of a very dark colour on their upper side, and white and downy on their under. The young branches have a purple bark covered with a white down, but the bark of the stem and older branches is grey.

"In moist and boggy places," says Evelyn, "they will flourish wonderfully, so the ground be not spewing, but especially near the margins and banks of rivers, and in low, sweet, and fertile grounds."

The best sort of abele-trees having been originally procured from Holland, it is in some places known by the name of *Dutch Beech*, and it is recorded that, about A. D. 1659, ten thousand abeles were imported from Flanders, and transplanted into many countries.

They are remarkable for the quickness of their growth, and the Dutch, with whom the abele is a favourite, consider a plantation of those trees, made at the birth of a daughter, to be an ample provision for a marriage portion. In England, some abeles, planted twenty-five years, measured six feet in circumference; and another instance is given of a tree twelve years old girting four feet, and increasing from three to four inches each year in circumference. An abele-tree is mentioned by Evelyn, as growing at Sion, near Brentford, which was lopped in February, that in the month of October, in the subsequent year, produced branches as big as a man's wrist. Its height varies from about forty-five to one hundred and twenty feet. The colour of the wood is white with a tinge of umber or brown, and from a slight discolouration of the outer edge of the annual rings their increase is easily noted. The wood is of a very uniform texture.

If we reckon the stiffness of oak to be 100, the stiffness of abele may be taken at a tenth less. It is nearly $\frac{15}{100}$ tougher than oak, but has not more than $\frac{7}{10}$ of its stiffness. A cubic foot when dry weighs about 32½ pounds avoirdupois; and the medium cohesive force of a square inch is 5711 pounds avoirdupois.

It is less combustible than many other woods, burning "untowardly, and rather moulders away than maintains any solid heat." On this account it is not well adapted for fuel.

The abele is enumerated by Vitruvius (B. xi.) among woods used for building: and as being in many situations serviceable from its "toughness," and also from its colour and lightness to be proper for carving.

Evelyn mentions its being an "incomparable wood for butchers' trays, and for all kinds of turnery and toy-work, and for the carver." From the lightness of the wood saving much of the expense of the carriage, it is well adapted for packing-cases, and much used for this purpose by foreign merchants. As also for its not being liable to split in nailing. It is a favourite with bellows' makers; and the inhabitants of a district in Holland, which is noted for its production, make shoes of this wood, of which they export immense quantities, beside supplying exclusively the province of Holland. For all sorts of wooden domestic vessels it is much esteemed, and in particular situations for ships' pumps. It is used for carts, as well probably from a property which it possesses in a remarkable degree, of giving way to the nail, and closing upon it afterwards, as for its lightness and toughness. The wood of the abele has been long recommended by old women for "making the shelves of cheese-rooms, and for farm-houses in general, as neither mice nor mites will attack it." The recommendation has been repeated by a recent compiler, without any qualification.

The durability of the abele, when used in building, depends entirely on its situation, with regard to dryness or moisture. In contact with moisture it quickly rots and decays; but under cover and in a dry and well-aired situation, its durability is equal to that of pine timber.

Besides its not being liable to shrink, it has been strongly recommended for floors and wainscotting, on account of its lesser inflammability; but its softness is an objection to its use in flooring. "Lord Sheffield," says Pontey, "has lately made some floors, which, in appearance, are superior to any thing he had seen, whether of deal or oak, and he sees no reason to doubt its durability. Floors, however, he considers as one only of the many inferior purposes for which it is applicable, as it is certainly proper for almost every article of furniture usually made of mahogany. For the lighter descriptions of this wood, now so fashionable, (and high priced,) it might be made a very good substitute without any other addition to the natural colour of its fibres, than the means cabinet-makers generally resort to in order to heighten the colour of such wood. And with respect to the sap, and where more of colour is required, the aquafortis stain will instantly produce it, so far as that it would be difficult to distinguish it from real mahogany. He thinks it equal to the best in colour and smoothness of surface, and much superior to the plain or inferior sorts in these respects, as well in transparency as variety; and it has the further advantage over mahogany and most other woods, that it takes but little of either oil or rubbing to produce upon it a sort of mellow shining surface, so much admired in furniture, that has been some years subjected to proper attention."

In landscape gardening, the abele is employed to screen unseemly or unimportant buildings, or walls, for which it is well adapted, from the denseness of its foliage. Its shade is reckoned wholesome, and its "umbram hospitalem" is celebrated. In modern practice, the abele is placed at a distance from walks or dressed lawns, as its suckers, and the litter which its leaves produce in autumn, are detrimental to that verdure and neatness of turf which are essential in those situations. Its aspiring form harmonizes finely with the horizontal lines of Greek building; and few trees can be introduced with a happier effect in city vistas, where the streets are wide and the houses lofty. One beauty poplars possess over almost all other trees in landscape scenery, is the waving line which they form when agitated by the wind. Most trees under these circumstances are only partially moved; one side is at rest while the other is in motion: but the poplar, bending in one continuous sweep, gives a variety and an air of animation to the scene that is altogether admirable.

Abel-the-Great. A large stone, on which the ark was placed, when it was sent back by the Philistines.

Aben-bohan. The boundary stones which among the ancient Jews marked the territorial separation of the tribes of Judah and Benjamin.

Aberthaw-lime-stone. See *Mortar.*

Abreuvoir. (Fr.) A watering-place. The engraving represents a very celebrated abreuvoir in Grand Cairo, in the modern Arabian style.

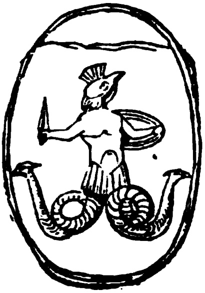
In masonry, *abreuvoir* is the joint between two stones, or the interstice left to be filled up with mortar or cement, when either are to be used.

Abreast. *In naval architecture.* Within the ship, denotes on a line with the beam, or by the side of any object aboard.

Abraxas, Abracax, Abrasas. *In decoration.* The name of a species of gems and small statues, having figures of beetles, serpents, with human heads, &c., and words, and letters in the Roman, Greek, Phœnician, and other characters, engraved and sculptured upon them.

The word is derived from the

solar divinity Abraxas, and these stones and statues are thought to have been worn as amulets, (sometimes called *abracadabra*,) by the worshippers of that god, to preserve them from misfortune. Their origin and uses are still considered to be good debatable subjects among antiquaries. The most ingenious of the many theories proposed for their explanation, appears to be that suggested by Hieronymus, in which the figures and cabalistic letters are considered to be allegorical of the motions of the sun and heavenly bodies. In this theory the figure in the engraving, representing a man with the head of a cock, armed with a buckler and poignard, and his extremities also decorated, and ending with the head of this bird, may be satisfactorily deciphered.



The cock, among some ancient people, was sacred to the sun, whose appearance he announced by his crowing; the cock was also sacred to Æsculapius, the god of medicine, which is indicated by the legs being formed like serpents, and terminated with the head of a cock; Æsculapius is himself typified by the serpents. In the position which the god occupies, he is the image of the decline (or lower part) of the sun, or autumn and winter. The figure is in a menacing attitude, or defending himself (or votaries) from the fury of the suffocating Typhon, which is considered as an evil genius; this then makes the engraved figure to represent the benevolent and protecting being Abraxas.

The next sculpture represents the god Anubis, with the head of a dog, symbolical of the constellation of that name, concurring with the rise or fall of the waters of the Nile, which is farther indicated by Abraxus holding in his hand a vase to contain the water.

Absis. See *Apsis.*

Abutment. The extremity of a bridge; the last or boundary pier of the high water-way; the land-stool; land-pier; sometimes the revetment, or facing of masonry of this pier.

The steep banks of rivers, or the sides of ravines, being composed of rock, or other materials of that consistency, as will allow the arch to rise or spring from it, without the intervention of a pier, or a revetment of masonry, is an instance of a *natural abutment.*—The abutment is said to be *artificial,* when a mass of masonry is formed to resist the entire pressure and thrust of the arch.—Many of the mountain bridges of all countries are instances of arches rising from the natural abutments. In the bridges constructed on rivers with low shores, are instances of artificial abutments. Among English and French architects, the natural abutment is seldom alone trusted to; even in high rocky banks, it is not unusual for them to form an abutment of masonry.

In the construction of abutments the same care is required in laying the foundations, the joining of the stones, and the filling up, or *backing*, as in the formation of the *piers*, (which see.) Abutments are often strengthened with *counterforts* behind them. It has been recommended, by some authors, to lay the stones of which the abutment is composed, with joints radiating more or less to the centre; but the advantages said to be derived from this practice are quite hypothetical, for, much as has been written on the subject, the value of the forces acting to overturn a pier, and those increasing its stability, are equally unknown.

The following *rule* has been given in a recent compilation, to determine the proper thickness of an abutment.

The square of the height of the abutment is to be multiplied by 160, and the product divided by the weight of a square foot of the arch, and by the rise of the arch: unity then is to be added to the quotient, and the square root to be extracted; then diminish the square root by unity, and multiply the diminished root by half the span of the arch—the quotient will be the *thickness* of the abutment. For an arch of 200 feet span, with a rise of 18 feet, this will give an abutment nearly 33 feet thick, which *may* be correct: but with only *attempts* at certainty for a guide, it were safer to trust solely to the *tact* derived from observation or *experience*. See *Bridge, Counterfort, Pier, Revetment, Retaining-wall.*

In a range of casemates, or other bomb-proofs, in military architecture, the same terms apply which are used in speaking of a bridge, or any other work composed of a series of arches—the intermediate walls being called piers, and the end walls abutments.

Abutment, among carpenters and joiners, is the joint or joining of two pieces of timber; in which the fibres or grain of the wood of the abutting pieces are placed as nearly as practicable in a direction at right angles to each other.

Abydos, Bridge of. "While Xerxes," says an ancient historian, "was preparing to go to Abydos, numbers were employed in throwing a bridge over the Hellespont, from Asia to Europe. They, on whom the office was imposed, proceeded in the work, commencing at the side next Abydos. The Phœnicians used a cordage made of linen, the Egyptians using a cordage made of the bark of the biblos—the bridge was no sooner completed, than a great tempest arose, which tore in pieces and destroyed the whole of their labour.

"When Xerxes heard of what had happened, he was so enraged, that he ordered three hundred lashes to be inflicted on the Hellespont, and a pair of fetters to be thrown into the sea. It is said, that he even sent some executioners to brand the Hellespont with some mark of infamy; but it is certain that he commanded those who inflicted the lashes to use these barbarous, mad expressions. 'Thou ungracious water, thy master condemns thee to this punishment for having injured him without provocation; Xerxes the king will pass over thee, whether thou consentest or not: just is it that no man honours thee with sacrifice, for thou art insidious, and of an ungrateful flavour.' After thus disgracing the sea, the king commanded those who presided over the bridge to be beheaded.

"A bridge was then constructed by a different set of architects, who performed it in the following manner. They connected together ships of different kinds, some long vessels of fifty oars, others three-banked galleys, to the number of three hundred and sixty, on the side towards the Euxine Sea, and three hundred and thirteen on that of the Hellespont. The former of these were placed transversely, but the latter, to diminish the strain upon the cables, were placed in the direction of the current. When these vessels were firmly connected to each other, they were secured on each side by anchors of great length on the upper side, because of the winds which set in from the Euxine; on the lower, towards the Ægean Sea, on account of the south and south-east winds. They left, however, openings in three places, sufficient to afford a passage for light vessels which might have occasion to sail into the Euxine, or from it; having performed this, they extended cables from the shore, stretching them upon large capstans of wood. For this purpose they did not employ a number of separate cables, but united two of white flax with four of biblos; these were alike in thickness, and apparently so in goodness; but those of flax were in proportion much more solid, weighing not less than a talent to every cubit. When the pass was thus secured, they sawed out rafters of wood, making their length equal to the space required for the bridge; these they laid in order across upon the extended cables, and then bound them fast together. They next brought unwrought wood, which they placed very regularly upon the rafters; over all this they threw earth, which they raised to a proper height, and finished all by a fence on each side, that the horses and other beasts of burden might not be frightened by looking down upon the sea."

Thus far the Greek writer, but his account has been observed by some of his commentators to be (in one or two instances) inconsistent; the vessels he describes as placed transversely must reach to a much greater extent than the same number placed side by side; and, since the Hellespont in the neighbourhood of Abydos, has a very considerable bend in its course, first running northward from Abydos towards Sestos, and then taking a pretty sharp turn to the eastward, that it might truly be said of the two lines of ships on different sides of the angles mentioned, the ships in one line presented their heads to the Euxine, the others their sides, although the heads of both were presented to the current. The different numbers in the two lines certainly indicate different breadths of the strait, which can only be accounted for by their being at some distance from each other, for it cannot be said that the line was placed obliquely across the strait. The cables extended from each shore appear to have been for the sole purpose of supporting the bridge-ways—the ships were kept in their places by anchors a-head and a-stern; by the lateral pressure of each other, and by the side fastenings.

As no mention is made of the *current* making anchors necessary on the upper side, it is conjectured by another commentator, that some words expressing that circumstance may have been lost in the original, and that it is probable that each range of vessels were secured by anchors above and below—those placed with the current having anchors from head and stern, the transverse ships having them from each side, so that there would be in all four sets of anchors—perhaps the cables extended from shore to shore served each range of vessels on the inner side; if so, there would only be two sets of anchors, one from the upper sides of the transverse ships, the other from one end of those which lay side by side.

Abydus. A town in Egypt, celebrated for containing a magnificent temple, built by Ismandes, in honour of Osiris, and which was further remarkable, from its being the only shrine in Egypt where singers and musicians were denied entrance. During the reign of Augustus, the town had dwindled into a village; and at the present day, it is in ruins, and a desert; but the greater part of the building to which it owed its fame yet remains, to attest its ancient splendour.

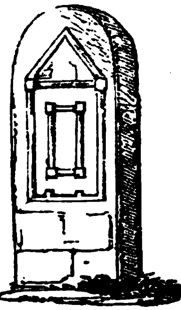
The entrance to the temple is under a portico, 60 feet high, supported by two rows of large marble columns; beyond is the temple, 300 feet in length, and 140 feet wide At the entrance is an immense hall, containing twenty-eight columns, 60 feet high, and 19 in circumference at the base. They stand 12 feet asunder. The enormous stones of the ceiling are so perfectly joined and inserted one in the other, as to appear to the eye one sole marble slab, 126 feet in length, and 66 in breadth. The walls are loaded with innumerable hieroglyphics, among which are a multitude of animals, birds, and human figures, wearing pointed caps (still worn by Egyptian priests, on festivals,) with a piece of pendant stuff behind, and clothed in open robes, which do not descend below the waist. The rudeness of the sculpture bespeaks antiquity and art in its infancy.

At the further end of the first hall is the great door, which leads to an apartment 46 feet long, and 22 feet wide. Six square pillars support the ceiling; and four doors at the corners lead to four other chambers, to which, at present, the heaps of rubbish debar all entrance. The last hall, 64 feet long, and 24 wide, contains staircases leading to the subterranean parts of this grand edifice, with sculptures and hieroglyphics, similar to the other chambers. Six lions' heads, on two sides of the temple, serve as water-spouts: a very singular staircase leads to the summit of the building—it is formed by the stones being inserted into the wall, from which they project 6 feet, so that being only sustained on one side, they appear suspended in the air.

Neither the walls, roof, nor columns, of this edifice are injured by time, and did not the hieroglyphics, which are defaced in many places, show marks of age, it would seem as if newly built; such is its solidity, it will stand for ages, unless purposely destroyed. The colossal figures, the heads of which serve as ornaments to the capitals of the columns are in basso-relievo, but all the remaining hieroglyphics within the temple are cut into the stone. On the left of this great building there is a smaller one, at the further end of which stands a kind of altar. This appears to have been the *sanctuary* of the temple of Osiris. See *Egyptian Building*.

Abyssinian Buildings. The most remarkable architectural objects which remain in the kingdom, are found in the province of Tigre, on the site of the ancient city of Axum, in former times the capital of the empire of Abyssinia. On approaching Axum from the modern town of Adowa, the first object which attracts attention is a small obelisk, about 9 feet high, at the foot of a hill on the right hand, at the summit of which stands the monastery of Abba Pantaleon, and immediately opposite a large square stone, with a Greek inscription. After passing between these, the modern town of Axum and its church begin to make their appearance; and upon inclining a little to the northward, leaving a number of broken pedestals on the left hand, a full view of the "*large obelisk*" is presented, standing close to an immense daro-tree. This highly wrought and magnificent work of art is formed of a single block of granite, measuring full 60 feet in height. All its ornaments are very regularly disposed and boldly relieved, which, together with the hollow space or recess running up the centre, and terminating with a patera at top, give a lightness and elegance to the whole form, which is probably unrivalled. On comparing it with similar structures of undoubted Grecian and Roman construction, it may be considered the most admirable and perfect monnment of its kind in existence.

Small Obelisk at Axum.

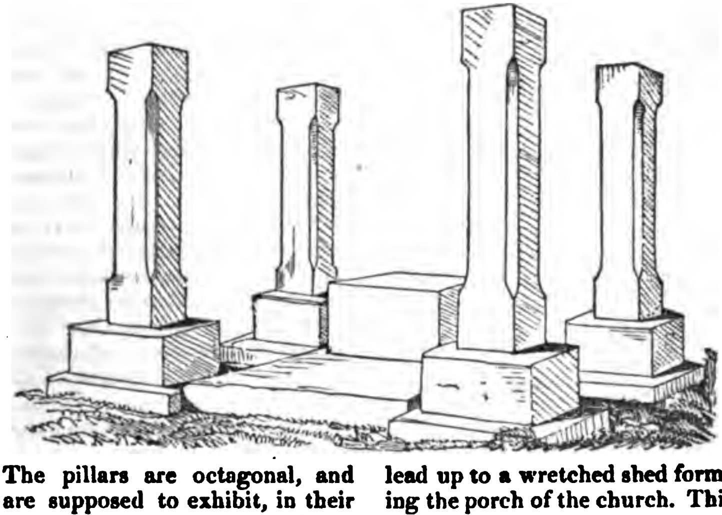


There are no hierogliphics on the obelisk, but its faces are covered with a repetition of an ornament of a peculiar description, similar in its details to that shown on the figure of the "small obelisk at Axum." At the bottom of the obelisk, a figure of a wooden door, and lock and latch, are carved as if to represent an entrance through it to some building behind. The lock and latch seem designed first to draw back, and then to lift up exactly in the manner those kind of locks are fashioned in Egypt and Palestine at this very day but were never seen in Ethiopia or at any time in use in Abyssinia It is conjectured that Ptolemy Evergetes, the third Grecian king of Egypt, after having conquered Axum, and overrun the neighbouring kingdoms, resided som time in this ancient capital o Ethiopia, "and being absolutely ignorant of hieroglyphics, then long disused, he left the obelisk he had erected for ascertaining his latitudes, ornamented with figures of his own choosing, and representations of the inventions of his subjects, and particularly the door for the convenience of private life, to be imitated by his new-acquired subjects, the Ethiopians, to whom it had hitherto been unknown."

Several other obelisks lie broken on the ground at no great distance, one of which is of still larger dimensions. The era of their erection, it is probable, could not have been prior to the reign of the Ptolemies, as their style of architecture is strictly Grecian, and similar to the one which we have already described. The tradition of the country ascribes them to a later period—the reign of the Emperor Acizana, about three hundred years after Christ; but the native workmen of that age were probably unequal to complete such chaste and elegant works of art. Whatever era may be assigned to them, opinions seem to coincide that they were the work of Grecian artists; and what gives additional strength to the conjecture, is the fact of its having been the custom of the ancient Abyssinian emperors to procure artificers ot the Greek nation from Egypt. See *Obelisk*.

The monument called the King's Chair, is also situated at Axum. It is a small square enclosure surrounded by pillars, on a seat within which the ancient kings of Ethiopia used to be crowned. The pillars are octagonal, and are supposed to exhibit, in their form and finish, traces of the workmanship of the lower Roman empire. The seat is of granite, as well as the pavement and pillars, and it is supposed that, formerly, the pillars were crowned with small images, probably of metal, of the Dog Star, and that the pillars are Egyptian.

Axum Chair.

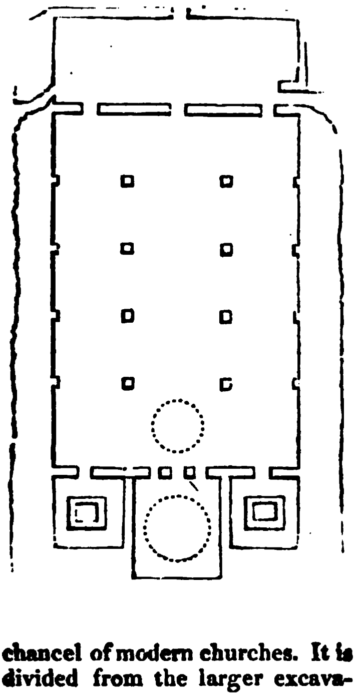


The church of Abba Garima is said to have been built about the year A. D. 560: thirty rough steps lead up to a wretched shed forming the porch of the church. This is approached through an open area, walled round; in the centre of which is the main building, of a square form, and divided by a passage that runs through it into two unequal compartments. It is built of solid masses of stone and timber, which have in some places been strengthened by bars of iron; and the *butt ends* of all the beams and planks have been *rounded, and left projecting as* *ornaments.* Within it is ornamented with some miserable paintings.

Of the many singular excavations which are found in this country, that of the church of Abu-has-ubha is one of the most interesting.

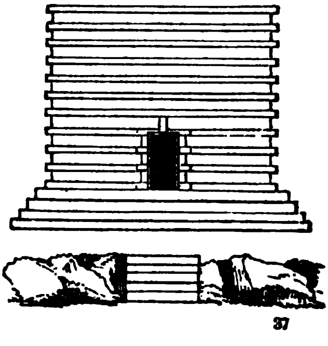
In the front of the excavation is a thatched and two-storied entrance, built in a style resembling that employed by the Portuguese —from this three doors lead into an oblong square room, the dimensions of which are about 50 by 30 feet, supported by two rows of columns, each consisting of four pillars and two pilasters. The pillars are about three feet in diameter, resembling the Tuscan order in their proportions. Beyond this apartment is a room, answering in some degree to the chancel of modern churches. It is divided from the larger excavation, by two square pillars, and has a dome-shaped ceiling, about 40 feet high, of very excellent workmanship. On each side is a smaller room, communicating by a door and window with the larger excavation. The ceiling in front of the centre room, in the larger excavation, is hollowed out into a dome of about 30 feet high, curiously painted and carved; and in front of the side-rooms it is also adorned in the same manner, but without the dome. The floor is flagged with square stones, and the walls are carved and ornamented with crosses, paintings, and inscriptions in the Ethiopic character, which are said to entirely consist of sentences taken from the Bible. In each of the side cells is a tomb. On the outside several tombs are excavated in the rock, and only covered over by loose stones. It is also conjectured that this church was the work of Egyptian artists, during the reign of the emperor Lalibala (about A. D. 1020).

Plan of the Churchof Abu-has-ubha.



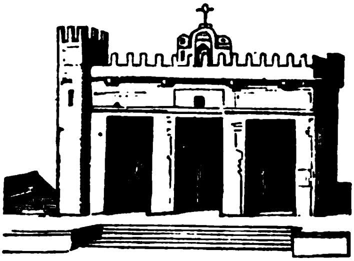
The external elevations of some of these excavations are in a very simple taste; and travellers who have visited Abyssinia speak in high terms of their general effect, being in admirable accordance with the simple grandeur of the surrounding scenery.

Elevation of an Abyssinian Excavated Church.



The church at Axum is a modern erection, and the first impression on beholding it, is its great resemblance to gothic houses in England. The colonnade in front is supported by four massive stone pillars, about five feet in diameter, composed of small stones, and covered with plaster. It is flat-roofed, laid with mortar and stucco, and its parapet surrounded with gothic ornaments.

Modern church at Axum.



It is 111 feet in length, and 51 in breadth: is approached by two flights of steps. The upper flight only is shown in the engraving. A row of broken pedestals still remaining indicates the principal entrance. The tradition of the neighbourhood says it was erected on the site of an ancient temple; the fifty-five broken obelisks forming the ornaments of its approach.

There is no country in the world in which there are so many churches as in Abyssinia. Though the country is very mountainous, and, consequently, the view very much obstructed, it is seldom that you see less than five or six of these buildings; and if you are on a commanding ground, five times that number. In Gondar there are forty-two churches to a population of ten thousand families. Every great man that dies thinks he has atoned for all his wickedness if he builds a church in his lifetime or leaves funds to erect one after his death The king builds many —wherever a victory is gained, there a church is erected.

The situation of a church is generally chosen near running water for the convenience of absolution. They are always placed on the top of some beautiful round hill which is surrounded with rows of trees called azz (the Virginia cedar), and which grow in this climate to great beauty and perfection. This plantation of cedar is interspersed at proper distances with a number of the trees called cusso.

All the country churches are round, with thatched roofs, their summits being perfect cones. The outside is surrounded by a number of wooden pillars, formed of the trunks of the cedar-tree placed to support the edifice; about 8 feet of the roof projecting beyond the wall of the church, which forms a colonnade or an agreeable walk in hot or rainy weather. The inside of the building is formed in several divisions, according as is prescribed by the law of Moses: the first, of a circle somewhat wider than the inner one—here the congregation sit: within this is a square, and that square is divided by a veil or curtain, in which is another small division, answering to the Holy of Holies: this is very narrow

Church of Muccallahi.

so as to allow only the priests to enter it.

They are full of pictures painted on parchment, which are nailed upon the walls in a manner little less slovenly than we see paltry prints in country English alehouses. There has always been known and practised among the scribes a species of painting, or rather a sort of daubing, much inferior to the worst of our sign-painters. In some instances, for the adorning of a particular church, they get a number of pictures of saints, on skins of parchment, ready finished, from Cairo, in a style very little superior to these performances of their own. They are placed like a frieze, and hung along the upper part of the wall. St. George is generally to be seen there, with his dragon, and Demetrius fighting with a lion.

Nothing embossed or in relief ever appears in any of the churches. All this would be reckoned idolatry. On this account they do not wear a cross on the top of the ball of the sendick or standard, because it casts a shade. But there is no doubt that pictures have been used in their churches from the earliest age of Christianity.

The Palace at Gondar stands at the west end of the city, and was formerly a building of considerable importance. It is built in a square form, and flanked with square towers four stories high; the palace properly consists of a number of houses detached from each other, with one room in each; in one of these the coronation is performed, in another the king sits in festivals, a third is called the gold house, and another the brocade-house, where the wardrobe and gold stuffs used for presents, or received as such, are laid up; and a square tower containing many fine apartments.

The houses stand in a square court, nearly a mile in circumference; a substantial wall, 30 feet high, built of stone and lime, in the time of the Emperor Facilidas, by masons from India, surrounds all the buildings; a platform roof, connecting the outer and inner walls, has battlements, loop-holes, and other conveniences for discharging missile weapons from its parapet. The interval, between these walls, forms a covered way by which you can go along the whole, and look into the street; a church is built to each corner. The part built by Facilidas, has in part fallen into ruins, although there is still ample lodging in the two lower floors of it; the audience-chamber being above 12 feet long.

A succession of kings have built some apartments, or houses of one story high, in different parts of the area or square, *of mud and clay* only, and thatched with straw, in the fashion of their country, according to the taste of the reigning prince; these mud erections are, however, magnificently lined and furnished within. Some idea of the Abyssinian taste in decoration may be formed, from an account of the operations of the Emperor Yasous II. A rebellion and massacre happening at Smyrna, many Christian inhabitants fled to Cairo for protection; but finding that city in a still less peaceable state than the one they had left, repaired to Jidda, on their way to India; missing the monsoon, and being destitute of money and necessaries, they crossed over the Red Sea for Massuah, and came to Gondar. Twelve of them were silversmiths, very expert in that fine work called filligrane, who were all well received, and speedily employed by the king, as their own taste directed them, in his palace at Gondar, which he was then ornamenting, by the hands of these and other Abyssinians, sons of Greek artists whose fathers were dead. The emperor finished the decoration of his presence-chamber in a manner truly admirable. The skirting, which in our houses is generally of wood, was finished with ivory, as high as four feet from the floor. Over this were rows of mirrors, from Venice, joined together, and fixed in frames of copper, or cornices, gilt with gold. The roof, in gaiety and taste, corresponded perfectly with the magnificent finishing of the walls of the room. It was the work of the Falasha (or Jews), and consisted of painted cane, split and disposed in Mosaic figures, which produces an effect of great lightness and beauty.

The king began another chamber of equal magnificence, consisting of plates of ivory, with shades of all colours stained in each plate at proper distances; but he did not live to finish it.

The great hall of the governor's palace at Antalow, may be aptly compared in size to an English barn, but without its comfort. The residence of another man of high rank near Tcherkin, is described as being built of cane very artificially disposed; the outer wall of fascines of cane, so neatly joined together as to be impervious to wind or rain; and the inside of the state-rooms are hung with long stripes of carpeting, and the floors covered with the same material.

Permanent *bridges* are almost unknown in this country: there is one very solid good stone bridge of four arches, built by the Emperor Facilidas, on the river Mogetch, near Gondar.

Much as Gondar excels in appearance the other towns of the kingdom, this is more specious than real;—for the composition splendour of the churches which are the great ornament of the capital, the Abyssinians are indebted to the Portuguese, who erected them during the continuance of their power, and left them as models for artisans of the present time. But the want of wood and stone, added to the want of enterprise among the Abyssinians, render the little science which still glimmers in the country almost useless, for they are ignorant of the art of making brick; the few Greek artisans, at present in the country, are little better than native workmen. The roofing of the houses, and neatness of the churches, are admirable, but this is performed here as elsewhere by the Falasha.

The general form and appearance of Abyssinian buildings are exhibited in the modern town of Axum. The houses in the town of Abha are of a different, but also common form; in villages built on the sides of hills the roof of the cottage being a continuation of the natural slope of the ground: the smoke is conveyed from the inside by a hole in the roof.

At Adowa the buildings are all constructed of rough stone, cemented with mud, instead of mortar. Mortar not being used throughout the empire, except at Gondar, where it is very bad. The roofs are in the usual form of a cone, and thatched with a reedy sort of grass, something thicker than wheat-straw. The Jews, called Falasha, enjoy this trade of thatching exclusively; they begin at the bottom, and finish at the top.

In building these houses, the only tools employed are a kind of adze to shape the stones, and the blade-bone of a bullock to dig out the earth for the foundations, and to temper the mortar; and, notwithstanding these imperfect instruments, the operation is conducted with great expedition. The working of iron and brass is general throughout the country, and both are commonly employed in their buildings.

Smiths are called Buda, and a strange superstition is attached to their employment. Every man engaged in the occupation being supposed to possess a power of transforming himself into a hyæna, during which he is thought to be capable of preying even upon human flesh. And it is also believed, that if, during the period of his transformation, he should experience any bodily injury, that a corresponding wound would be found on his proper body; a belief which is inconceivably strong throughout the country.

The houses in Maitshaw are of a very singular construction; the first proprietor has a field, which he divides into three or four, as he pleases, (suppose four), by two hedges made of the thorny branches of the acacia tree. In the corner, or intersection, of these two hedges, he begins his low hut, and occupies as much of the angle as he pleases. Three other brothers, perhaps, occupy each of the three other angles—behind these their children place their houses, and enclose the end of their father's hut by another, which they make generally shorter than the first, because broader. After they have raised as many houses as they please, they surround the whole with a thick, and almost impenetrable abbattis, or thorny hedge, and all the family are under one roof, ready to assist each other on the first alarm of danger, or of an enemy.

The monastery of Aba Asfa, now in ruins, is evidence of a better style of construction having been practised in Abyssinian building. Part of the walls, forty feet high and five feet thick, have been built with large masses of stone, seven feet long and 20 inches broad, and fitted so exactly to one another, as scarcely to leave a visible interstice between them. No mortar or other fastening having been made use of throughout the building.

The Shangalla, who were formerly a very numerous people, divided into several tribes, during the fair half of the year live under the shade of trees, the lowest branches of which they cut near the stem on the upper part, and then bend or break them down, planting the ends of the branches in the earth—these branches they cover with the skins of wild beasts. After this, they cut away all the small or superfluous branches in the inside, and so form a spacious pavilion, which, at a distance, appears like a tent; the tree serving for the pole in the middle of it, and the large top overshadowing it. Every tree is then a house, under which live a multitude of black inhabitants until the tropical rains begin. Nothing can be more beautiful than these shady habitations; but they have the fatal disadvantage of being easily discernible from the high grounds, and thus guide their enemies to the places they inhabit. The soil, called by the Abyssinians Maraga, when wet by the tropical rains, dissolving into mire, forces these savages to search for winter quarters; their tents under the trees being no longer tenable—they retire (with their food all dried in the sun) into caves dug into the heart of the mountains, which are not in this country basaltes, marble, or alabaster, as is all that ridge which runs down into Egypt along the side of the Red Sea, but are of a soft gritty sandy stone, easily excavated, and formed into different apartments.

The Shiho, another tribe of savages, have neither tents nor cottages, but either live in caves in the mountains, under trees, or in small conical huts, constructed of a strong grass like reeds.

The houses at Arkeeko are also formed of grass, with a few of clay. At Thalassa, the Hazorta tribe live in caves, or cabins, just large enough to hold two persons, and covered with an ox's hide.

The Ogows, of the province of Avergale, another tribe, invariably construct their buildings without mortar; the better sort of buildings being constructed in the characteristic form of ancient Egyptian temples.

At Dankali, in the Bay of Amphila, and which formerly was comprehended in the Abyssinian kingdom, a tribe of the Hazorta form their huts like the wigwams of the American Indians, covering them with mats made of the leaf of the doom-tree. Their rude tombs have a striking similarity to some Egyptian monuments. In a secluded spot between two hills, one of their burying-grounds was discovered. The tombs were rudely constructed in the exact shape of pyramids, with stones cemented together with chunam; some of them were entirely covered with this material; the base of one which was measured occupying a space of full ten feet square.

ACACIA. (*Robinia Pseudo Acacia*). The common, false, or bastard acacia, is a native of the American States, where it is known by the name of the locust-tree; being well furnished with leaves, which appear late in the spring, and fall off early in the autumn, and these being of a brilliant rich green, make a fine appearance. The finely-pinnated leaves and pendulous white flowers in pretty long branches hanging down like those of the laburnam, add greatly to its beauty—the flowers, however, are not always produced, and when they are, they last only for about eight days, and appear in June—they smell very sweet, and perfume the air around them.

The acacia requires to be planted in a sheltered situation, for although "adorning our walks with their exotic leaf and sweet flowers, and very hardy against a pinching winter, they are not so proof against blustering winds."

The acacia will grow well in almost any soil, but the trees thrive best in one of a light sandy nature; here they have been known to shoot 6 feet in one year. The wood, when green, is of a soft texture, but becomes very hard when dry. It is of an agreeable bluish yellow colour, having a reddish tinge in the pores. One side of its annual ring is very compact, and the other slightly porous, and in working it, there is not much difference between the labour, and that required for oak. Hassenfratz (*Traité de l'art du Charpentier*), states the average length of its trunk in France to be about 32 feet, and about 2 feet in diameter. A locust-tree in Yorkshire, three feet from the ground, measured 4 feet 10 inches in circumference, and was 60 feet high.

The wood makes excellent fuel, and its shade is less injurious to grass than that of most other trees. In New England, the leaves afford a wholesome food for cattle: horses seem to like it, and hogs are fond of it.

The value of the acacia is very little known in England, but is highly prized in North America, and said to be superior to the laburnam; being close-grained, hard, and finely veined, it is more valued by the American cabinet-maker than any other wood whatever. Pursh, in his *Flora*, asserts that being nearly incorruptible, it is equally useful for posts and gates. At New York it has been found, upon repeated trial, that posts for rail-fencing of acacia stand wet and dry next the ground, better than those of any other wood in common use, almost as well as posts of swamp cedar. Gate posts of this timber, on an estate near Baltimore, have remained fresh for nearly a century. Most of the houses which were built at Boston, in New England, on the first settling of the English there, were built of this timber, which, in 1782, were firm and sound as when erected. Among those who use the wood it is reckoned better than the best white oak for the axle-trees of carriages.

The first experiment to employ the locust-tree for ship-building purposes was made in Virginia in 1737. "I then happened," says Mr. Harrison, "to be acquainted with an ingenious shipwright that had been sent over by some merchants of Liverpool to build two large ships. I had frequent conversations with him respecting the qualities of the principal timber-trees of that country—he reckoned the oaks, elms, ashes, common to both countries, much inferior to the same sorts in England—but frequently spoke of the locust-tree as of extraordinary qualities, both for strength and duration; and if a sufficient quantity could be had, he considered it to be the best timber he had ever met with for building of ships. After he had finished his engagement with his employers, he put a small ship on the stocks for himself, but not having a sufficient quantity of iron, he substituted *trenails* of the locust-tree, and the experiment succeeded beyond his most sanguine expectations." It was many years afterwards, however, when they were used by an eminent ship-builder of New York, and since that, the practice has extended among the other ship-builders in North America. As yet, the use of the locust-tree has been confined to trenails, on account of its scarcity; but were it as plentiful as oak, it would be applied for more purposes by the shipwright, such as knees, floor-timbers, and foot-hooks, being much superior to oak for its strength and duration, and from the tree spreading into branches, affords full as large a proportion of crooks or compass timber as oak.

A cubic foot of acacia, in a dry state, weighs from 48 to 53 pounds avoirdupois. If we compare its *toughness* in an unseasoned condition with that of oak, it will not be more than $\frac{8}{100}$ less. Its stiffness is equal to $\frac{92}{100}$ of oak; and its strength nearly $\frac{26}{100}$; but were it properly seasoned, it might possibly be found much superior to oak in strength, toughness, and stiffness. A piece of unseasoned acacia, two feet six inches long, and an inch square, in the vertical section, broke when loaded with a weight of 247 pounds avoirdupois. Its medium cohesive force is about 11,500 pounds.

In *Landscape Gardening*, the acacia is only esteemed for its form, when young; but it is well adapted, at all ages, for copsewood and rough timber In plantations in dressed ground, they are seldom introduced, from their being liable to have their branches broken by strong winds, which renders them unsightly. Mr. Gilpin considers it, "even in England, a very beautiful tree, whether it feathers to the ground, or is adorned with a light foliage hanging from the tree;" but in consequence of its being least able, of all trees, to endure the blast, "its beauty is very frail and uncertain."

Academy. (*Academia*, Gr.) A public villa, or grove, situated in the suburbs of Ancient Athens, which is said to have derived its name from one Academus, an Athenian citizen, to whom it belonged (in the time of Theseus), and who devoted it to the exhibition of gymnastic exercises; others derive it from Cadmus, who first introduced the use of letters into Greece. It was adorned with shady groves, fountains, and temples, by Cimon; and was enclosed with a wall, by Hipparchus. Sylla cut down a great many of the trees, in his siege of the city.

The most interesting objects in this celebrated spot were the tombs of those Athenians, or their allies, whose services to the state gave them a claim to the grateful remembrance of its citizens; for "every Athenian that died, either in naval or land engagements, fighting for his country, had here a sepulchre; excepting those who fell in the battle of Marathon, for the tombs of these are raised, in memory of their virtue, in the same place where they died." First were the tombs of those who conquered Thrace, but were slain by the Edoni—of the Thessalian knights, who came to assist them against the Peloponnesians—near these was the sepulchre of the Cretan archers—of the Cleonæi, who came with the Argives into Attica—"also a sepulchre of those Athenians who fought against the Æginetæ, for that institution of the people was certainly just, which conferred the honour of public burial on servants, and inscribed their names on pillars, if they were such as had vigorously assisted their masters in battle;"—of Eubulus, the son of Spintharus, and those men whose virtue was not assisted by fortune—of those "who fell at Corinth, where the god evinced, in no trifling degree, as likewise afterwards in the Leuctrian battle, that those who were called bold by the Greeks, were nothing without the assistance of fortune."—"One column was erected over many, as the inscribed elegies evinced, who died in Eubœa and Chios, and on the continent of Asia, and in Sicily.—On another pillar were inscribed their names, who fell at Thrace and Megara; and likewise their names, who conquered the Syracusans.—Their sepulchres were likewise to be seen here that fought in a naval battle about the Hellespont—those that opposed the Macedonians in Chæronea—those that fought under Cleon, at Amphipolis—those that fell at Delium—those that Leosthenes led into Thessaly—those that sailed with Cimon into Cyprus—and those that followed Olympiodorus, who, though only thirteen in number, drove out the guard of the Macedonians—of Tolmides and his soldiers. Here, also, were the tombs of Pericles, under whose government Athens reached the pinnacle of her glory and refinement —and of Chabrias—of Phormio —of Conon—of Timotheus—Nicias, the son of Nicomedes, who was the most excellent painter of animals of his time—and Aristogeiton, who slew Hipparchus—of Ephialtes, the orator—and Lycurgus, the son of Lycophron, who, in collecting money for the public treasury, surpassed Pericles, the son of Xanthippus, by 6500 talents." Before the sepulchre of those who were slain by the Edoni, was a column, in which "Melanopus and Marcabas, two knights, are seen fighting;" there was also the tomb of Clesthenes, who first instituted the mode of distribution into tribes. "*All the rest of the Athenians are buried in the way which leads to the Academy,* and columns are placed on their tombs, with inscriptions, signifying the name and town of each individual." See *Cemetery*, *Cenotaph*.

Besides these memorials of statesmen and heroes, the groves of the Academy were adorned with altars to the Muses, to Mercury, to Minerva, to Hercules, an enclosure to Diana, in which were the images of Ariste, and Calliste; also a temple, into which, every year, they carried the statue of Bacchus.

In a corner of this grove, Plato purchased a small garden, and there he opened his celebrated school for the study of philosophy. From this circumstance is derived the usual meaning of the word *academy*, as a place for the instruction of youth, or for the study and cultivation of any of the liberal arts and sciences. (See *School*.) Cicero called one of his country seats by this name, where he had fine groves, and pleasant walks for the entertainment of his philosophical friends and visitors.

Among architects, technically, *academy* is a place for the reception of a society, and for the society itself, formed for the purpose of promoting and cultivating the science of design, by lectures and conversation; and where facilities are afforded to individuals to refine their taste, and improve in the art of drawing, by copying from antique remains, or models, procured at the expense of the society.

These are the two grand objects of modern academies of design, to which are sometimes added, that of forming a taste in the public for works of art, by a public exhibition of the productions of its members at stated times—of directing the studies of young artists into the proper channel,—of stimulating their perseverance, and ambition to excel in their art,—by a distribution of medals, and other academic honours—and also of enabling those aspirants who may have distinguished themselves, to reside for a certain time in Italy, for the further prosecution of their studies. Almost every European capital has its academy of the fine arts, embracing all, or some of these objects, and they are all composed of painters, sculptors, and architects.

The French have a Royal Academy of Architecture distinct from that of Painting, which was founded by the great Colbert, in 1671. Its members have the title of academicians, and enjoy some privileges of precedence in rank. There are two professors who lecture on the general principles of architecture, and others on geometry, mensuration, carpentry, *&c.* Every year they distribute two medals to the students, one of which is of gold; this prize entitles its possessor to be sent to Rome for several years as a student, at the expense of the Academy. The establishment of the Academy has been of immense benefit to the respectability of the body of French architects.

The Royal Academy of London, founded, in the year 1762, by George the Third, embraces all the objects which we have enumerated, as entering into the plan of European academies. It is under the immediate patronage of the king, and consists of forty members, called *academicians*, chosen from among the most eminent painters, sculptors, and architects in the kingdom; and a certain number of members called *associate* academicians, from among whom, a vacancy occurring among the academicians is supplied. In the list of associates there are several eminent engravers, but these are rarely elected to the higher honour. At the time of the formation of the Academy, neither their present numbers nor eminence could have been foreseen, and the charter of foundation limits the election of academicians to painters, sculptors, and architects. There are, however, instances where engravers have been elected academicians—being admitted under the title of painters.

The Academy is governed by a president and council, chosen from the body of academicians; —and the ordinary business of the institution, and care of its books and prints is entrusted to a librarian;—the museum to the *Keeper*, generally an academician who resides in the building; —the *visitors* who are annually appointed, to attend alternately to direct the students in their studies;—a *secretary*, *treasurer*, and other subordinate officers.—*Lecturers* are appointed who annually deliver a series of discourses on *painting*, *sculpture*, *architecture*, and *perspective*—and on the *anatomy* necessary for painters. The library is rich in books and prints relating to the fine arts, and is open to all the students at stated times—the museum of casts from the antique, is, through the munificence of his late majesty, one of the finest in Europe, and every convenience and facility is afforded to those who avail themselves of the privilege of drawing from them. In winter, the students who have attained a certain proficiency, or a medal, are admitted to *draw* from the "living figure," provided for that purpose by the Academy; and in summer, to *paint* from the same description of studies.

The only qualification required to obtain the privilege of studying in the Royal Academy, and to be admitted to all the lectures, and to the use of its library, is a certain proficiency in drawing, if the candidate be a painter or architect; and in modelling, if he be a sculptor. The drawings submitted for this purpose are to be made within the walls of the Academy, under the eye of the keeper, who generally suggests the subject of the design. These being laid before the president and council at one of their meetings, they judge from the specimens, whether the candidate has the requisite facility in the rudiments of his art, and admit, or reject him as they see occasion.

The establishment of the Royal

Academy is the only institution in England where architecture as a fine art is cultivated and encouraged. But candour extorts the confession, that although the advantages arising to architecture from its establishment have been manifold and important, both in promoting a love for its beauties in the public, and directing the taste of its professors, and liberally as the treasures of its museum and library have been thrown open to all, its *plan is but little calculated to benefit the student of architecture.*

The general principles of design, it is admitted, which are taught in its lecture-room, being common to all the arts, a knowledge of them is as essential to the architect as to the painter, and the advantages would on this admission appear to be equal. To the painter and sculptor however, the decorative parts of architecture are alone of any use, which confines the lecturer to *illustrations* and *principles* drawn from *ornamental and picturesque architecture;* this, then, will be the only part of his profession in which a student of architecture will acquire any information by his attendance at the Academy; any thing exclusively adapted to only one description of auditors could not with propriety be introduced into a system of instruction addressed in common to all the three classes.

It must also be admitted that there is no description of building in which utility alone must be studied, where a cultivated taste would not become apparent, even to ordinary observers, in a refined and elegant adaptation of the means to the end. But this is a class of buildings, in the arrangement and execution of which, not only all that the architect has learned at the Academy is of no use, but in which those decorations he has studied with care, and can apply with propriety and elegance, would not only be useless but thrown away. This description too ot buildings is neither the least numerous, nor the least important of those, which in the course of his profession, the architect is called upon to design and see carried into execution.

It is here that the *science and practice of construction*, instead of secondary, becomes of primary consideration,—but in every thing relating to it, the young architect is not only left without a guide, and without a stimulus to carry him through the most laborious portion of his studies, but his exertions are absolutely depressed. He is associated with painters, who can have no relish for practical details, and his works are to judged in a great degree not only by them, but by their standard of excellence. His productions therefore are to have a painter-like air, as well in effect as in composition; the result is obvious, in his search after and study of pictorial excellence and effect, instead of that simplicity, and of that attention to fitness and propriety, which are the grand essentials of architectural beauty, — his designs, when analyzed, are meretricious in style, gaudy in ornament, and not unfrequently impracticable in execution. The celebrated Peranisi may be instanced as an example of the truth of this position,—with an imagination of astonishing fertility, and an exquisite taste in detail, his whole system of architectural composition, was a manful setting of consistency at defiance, but producing compositions of wonderful splendour and beauty in the Royal Academy.

It is thus, that, in the struggle of an honourable ambition to cope with those who have unwisely been made his rivals, that a student of architecture loses a relish for the severer studies of his profession; and when the day of trial arrives, and his plans are to be carried into execution, it is too late to supply his deficiencies.

The formation of the Academy is productive of another evil, which has a deep and powerful influence, not only on the professors, but on the art itself. From the list of *academicians* being limited to forty, only a small number (three or four) can be architects—this is a great hardship on those individuals whose abilities and integrity have placed them in the upper ranks of their profession. These form the greater number, but have no bond of union among themselves, or fellowship with their three or four brethren in the Academy; and the result is, that the fine taste and independent practice of those (both in the Academy and out of it) who are an honour to their profession, are borne down and obscured by the activity of a host of rapacious *barbarians* around them, assuming the name, and usurping the functions, of an architect.

The same thing was the case in France, and gave rise to the Royal Academy of Architecture; and in all probability will continue to be the case in England, until some society be organized, where genius and taste may acquire vigour and influence, from their union and concentration, and which the public may look to, as offering a guarantee that the junior branches of the profession are properly grounded in their art; and also, where a check will be placed, for the purpose of controlling the discreditable practices of a few individuals, which have brought so much undeserved obloquy on the whole body.

It was with a view to raise the rank of the profession, as well as the art itself, that, about ten or twelve years ago, several architects of great respectability as individuals, and eminent for their talents as artists, attempted to establish an Academy of Architecture; but from some peculiarity in its constitution, it failed of receiving the support of the profession generally, and its meetings were discontinued. The volume of its *Transactions*, and one or two of its *occasional* publications, leave deep cause for regret, that so meritorious an institution should have been abandoned. Nothing would have had a greater effect than its example, in acquiring for the professors that rank in society to which they are entitled, in making the profession of an architect (as in good old times it has been) that of a gentleman, and the title one of distinction and honour.

Acanthines (from *Akanthos*). *In decoration*, a border or fillet ornament, with leaves of the acanthus. *Acanthine vases* and *pateræ* were those vessels ornamented with representations of acanthus leaves. Virgil describes the handles of Alcimedon's cup as adorned with them.

Acanthus (*Acanthos*, Gr., a thorn.) *In decoration*, the leaf which forms one of the ornaments of the Corinthian capital; and supposed to have first been used for that purpose by a celebrated ancient sculptor. "A Corinthian maid just marriage-able being seized with a disorder died. After her interment, her nurse collected and disposed in a basket the toys which had pleased her when alive, carried it to the grave, placed it on the top, and that it might endure the longer in the open air, covered it with a tile. The basket chanced to be placed over the roots of an acanthus, which being thus depressed in the middle, the leaves and stalks, in the spring season, issued outward and grew round the sides of the basket, and being pressed by the weight at the angles of the tile, were made to convolve at the extremities like volutes. At that time Callimachus, who for his ingenuity and excellence in the arts was by the Athenians called Catatechnos (or the first of artists) happening to pass by this tomb, took notice of the basket, and being pleased with the delicacy of the foliage growing around it, as well as with the novelty of the form, made some columns near Corinth, according to this model, and from thence established the symmetry, and determined the proportions of the Corinthian order."—*Vitruvius.*

The leaved capital however, it is remarked by Quatremere Quincy, appeared in Egyptian buildings long before the time of Callimachus. Although the account of Vitruvius may be incorrect, as far as regards the *invention* of the capital, it may and appears to be true as to the fact of Callimachus having first introduced the acanthus-leaf as a decoration into Greek capitals, instead probably of the olive, or laurel. The great variety also which is observable in the decorations of ancient capitals is also an argument against its being derived as related by Vitruvius—their form and proportions being totally independent of the ornamental accessories, which appear to have been employed with an allegorical or religious meaning, oftener than from the taste or whim of the artists.

Wilkins, in his excellent translation of Vitruvius, also doubts the claim of Callimachus. "This fanciful and ingenious story" he thinks cannot be received as credible history—the tale, however, is valuable, as affording an intimation of the date of the introduction of the acanthus leaves into Grecian capitals. Callimachus lived towards the end of the Peloponnesian war, and was the artist so celebrated as the author of the lamp preserved constantly burning in the Temple of Minerva Polias at Athens. It is not improbable that the characteristic ornament of the style may have been imported from Egypt. The flower of the lotus, which generally formed the decoration of the ponderous structures of that country, in some of its fantastic varieties bears a near resemblance to the ornaments of the Corinthian capital; and as no great degree of intercourse prevailed between Greece and Egypt until the more recent period of their history, its late appearance in Europe is sufficiently accounted for.

The concluding years of the Peloponnesian War witnessed examples of the style in Greece, and no notice occurs in ancient writers of its previous existence.

Two sorts of acanthus are supposed to be imitated in the leaves of capitals. The one employed by the Greeks is known amongst us by the name of the *brank ursine* (from the officinal name *branca ursi*) and by the vulgar appellation *bear's-breech*, from its roughness giving it some resemblance to the shaggy hide of the bear. These terms are now seldom used, and the softer and more classical name of acanthus is generally given it in English. It is a native of Italy, Sicily, and the isles of the Archipelago, and forms an ornament to the flower plat in some states of Barbary.

The other variety, wild or prickly acanthus, is of a more diminutive character, as well in its size as in the indentations of its leaves, and other qualities, which give so much grace to the larger variety—this has, it is said by some writers on architecture, been the model followed by the architects of buildings of the middle ages.

A botanist, however, would not only be at a loss to distinguish any difference in the leaves used by architects (according to another author) of any period, but he would find it exceedingly difficult, if not impossible, to say *at all* what was the leaf used in the Corinthian capitals by Greek architects, or by those moderns who follow this practice. He thinks it possible, that to a "warm imagination" the leaves of the Corinthian capital (of the Temple of Jupiter Stator, for instance), may suggest those of the herb bear's-breech, but so many picturesque and sculpturesque beauties having been introduced, which make the resemblance so indistinct, that he considers it "an admirably beautiful ornament, which does not resemble any leaf with which we are at present acquainted."

Accesses. See *Passage*.

Accessible *Altitude*, in Geometry, the height of an object whose foot may be approached from a remote station.

Accessories. Those parts or ornaments, in architectural composition, whether designed or accidental, which are not apparently essential, either to the use or character of a building—they have been compared to episodes in poetry. See *Composition*, *Design*.

Accident. An effect or combination in architectural composition which was not foreseen: a deviation from regularity or symmetry without design. Sir Joshua Reynolds was of opinion that it might not be amiss for an architect to take advantage of accidents, to improve the composition of his designs—to follow them when they lead, and to improve (or assimilate) them rather than always trust to a regular plan. It often happens that additions have been made to houses at various times for use or pleasure; as such buildings depart from regularity, they now and then acquire something of scenery (picturesqueness?) by this accident, which might be successfully adopted by an architect in an original plan, if it does not too much interfere with convenience. The forms and burning of the streets of London, and other old towns, are accidents, without any original plan or design, but they are not always the less pleasant to the walker or spectator on that account. On the contrary, if the city had been built on the regular plan proposed by Sir Christopher Wren after the great fire, the effect might have been, as we know it is in some new parts of the town, rather unpleasing—the uniformity might have produced weariness, and a slight degree of disgust.

Accidental Point, in perspective, a point on the horizontal line, where certain lines parallel to each other, but not to the principal object in the picture, converge. From the position of the object represented, an accidental point may not be in the horizontal line

Accompaniments. Buildings or ornaments having a necessary connexion, or dependence, and which serve to make a design more or less complete—a characteristic peculiarity of ornaments.

Accouplement. Among carpenters, a tie or brace; sometimes the entire work when framed.

Acer. See *Maple*.

Acerra. *In decoration*, vases made like a little chest, or box, in which the ancients put perfumes and incense. These are frequently seen, in sculptures of sacrifices, in the hands of the Camilli, on the Trajan column; and in others, in the hands of the vestals. They are adorned with sculptures. The Thuribulum was also a vase for incense, but antiquaries are not agreed whether it was an acerra. It is sometimes introduced as a decoration, on the friezes of temples. Also, "an altar erected by the Romans, on which perfumes were burned before a dead body, until the period of its inhumation."

Achmin, a large town of upper Egypt, situated on the eastern bank of the Nile. "We admire there," says Abulfeda, as cited by Mr. Savary, "a temple, which is equal to the most celebrated monuments of antiquity. It is constructed with stones of a surprising size, on which are sculptured innumerable figures." Although it is now fallen from its ancient splendour, this town is still one of the most beautiful in Egypt. It appears to be the same as the *Chemmis* of Herodotus, which was called, in the time of Strabo, *Panopolis*; or the city of Pan; that deity being the object of the worship of its inhabitants. Herodotus says, that Perseus was a native of this city, and that his descendants had established festivals there in his honour. The ruins of the temple described by Abulfeda, are beyond the limits of the town, to the north. Nothing remains of it but the stones, which are of such magnitude that the Turks have not been able to move them. They are covered with hieroglyphics. On one of them are traced four concentric circles in a square: the innermost contains a sun: the two next, divided into twelve parts, contain, the one twelve birds, the other twelve animals, almost effaced, which appear to have been intended for the signs of the zodiac: the fourth has no divisions, and presents twelve human figures. Mr. Savary supposes the whole to represent the twelve gods, the twelve months of the year, and the twelve zodiacal signs. The Egyptians, Herodotus tells us, first divided the year into twelve months, and gave them the name of the twelve gods. The four seasons occupy the angles of the square, on the side of which may be distinguished a globe with wings. Mr. Savary thinks that this stone belonged to a temple dedicated to the sun, and that the whole of these hieroglyphics mark his passage into the signs of the zodiac. The columns of the temple have been partly broken, to make lime and mill-stones. Some of them have been transported into one of the mosques of Achmin, where they are placed without any taste, and others are heaped up in the square of the town. Mr. Savary tells us of a singular instance of imposture at this place: the people have been induced to believe in the divinity and immortality of a serpent, which they worship, and into which the soul of one Sheilk Haridi, a religious man, who lived above a century ago, is believed to have passed. Except the temple, the ancient buildings of Achmin have entirely vanished. It is in modern times noted only for its manufactory of cotton stuffs and pottery.

Acorn. *In naval architecture*, a little ornamental piece of wood, fashioned like a cone, and fixed on the uppermost point of the spindle, above the vane, on the mast head.

Acoustics. (Gr.) The science which comprehends every thing relative to the nature, operation, and effects of sound. Some knowledge of this science is very necessary to the architect of large edifices, particularly churches and places intended for public speaking, to guide him in regulating the proportions, so as to have the best possible effect on the hearers. The theory of whispering galleries and echoes is explained under the article *Echo*.

Acoustic Vessels. A kind of vessels made of brass, shaped like a bell, which, being of all tones within the pitch of the voice, rendered the sounds more distinct and audible, so that the ancient actors could be heard through all parts of the theatres, which sometimes exceeded 400 feet in diameter. Vases, harmonically tuned, were placed in various parts of the opera-house at Turin, and in some other theatres of Italy, but without the effect of augmenting the tone of the actor's voices, or of the instruments.

Acradina, the strongest, largest, and most beautiful of the four divisions of Syracuse It contained a forum, a senate-house, &c.

Acrolinthon. A celebrated statue of colossal proportions placed in the temple of Mars, which was enclosed in the citadel of the town of Halicarnassus.

Acropolis. (*Akrospolis*, highest city, Gr.) *In ancient military architecture*, a citadel, a Greek strong hold or fortress.

An Acropolis should, according to Alberti, occupy an elevated ground behind a city, from whence there are easy means of sallying against enemies or seditious citizens, or of receiving reinforcements. It should be the point of junction for all the town walls, and small because more easily defended. The foundations (of the walls) should be solid—of vast stones in an oblique line, on purpose that scaling ladders may be weakened by curvature, the besieging enemy be unable to avoid the stones discharged, and those sent from their engines fly off obliquely — the inner area should be thickly strewn with large stones to prevent mining. The Acropolis was not only to be a refuge during danger, but to be especially devoted for guarding matrons, virgins, and the sacred religious objects from profanation—for this reason there were temples erected in every Acropolis.

Every ancient Greek city appears to have occupied a peculiar plain, surrounded by a natural wall of mountains—or possessed its Acropolis and its plain, the former for refuge during war, and the latter for agricultural purposes.

Among architects, Acropolis is applied by way of eminence to the citadel of Athens, in which are some magnificent remains of ancient Athenian buildings, chiefly monuments raised by Pericles—which have not only reflected an imperishable glory upon his government, but so admirable are they in design and decoration, that the age in which they were erected they have distinguished above all other ages as that of inimitable taste and refinement.

The rock of the Acropolis is on three sides rugged and steep. On the west the ascent is less difficult, and here was the only approach. Near the summit is a broad flight of steps by which the terrace or platform in front of the Probylæum was approached. These extend the whole width of the principal portico, and were flanked by two square pedestals of considerable magnitude and height, which are thought to have supported equestrian statues.

The western end of the hill was 168 feet in breadth, an opening so narrow, that the space was filled up with a single building, which serving the purpose of a gateway, should at once adorn and protect the citadel. This work, the greatest architectural work in Athens, which equalled the Parthenon in happiness of execution, and almost surpassed it in originality and grandeur of design, is said to have cost 2012 talents. Of the 168 feet forming the dimension of the natural entrance of the Acropolis, 58 feet were left near the centre, for the great artificial entrance, the remainder being closed by two wings, which projected 32 feet in front of the grand colonnade of the entrance. The entire building was called Propylæ, from its forming a *vestibule* to the five gates.

The wall in which these doors were pierced, receded about 50 feet from the front of the artificial opening of the hill, which was itself thrown back a few feet beyond the natural entrance. The whole work has been compared by one of the ablest recent writers on the antiquities of Athens, to the front of a modern fortification:—the great vestibule or propylæum, resembling the curtain, and each of the wings presenting a face and flank like two adjoining bastions: the difference between it, and the front of a modern fortification, being such only as naturally arises from the difference of weapons, and of the art of war of the two ages, and from the admirable taste with which the Athenians combined utility with ornament.

This magnificent building was constructed entirely of Pentelic marble—the propylæum or vestibule consisted of a front of six Doric columns, mounted upon four steps, which supported a pediment. The columns are five feet in diameter, nearly 29 feet high, and have an intercolumnar space of about 7 feet, except between the two central columns, where a space of 13 feet is left for the sake of the carriage-way —behind the Doric colonnade was a vestibule 43 feet deep, the roof of which was supported by six Ionic columns standing in a double row, and thus dividing the vestibule into three aisles. These columns were nearly 34 feet high, their architraves being on the same line with the frieze of the Doric colonnade. The ceiling was laid upon marble beams resting on the side walls, and on the architraves of the two rows of Ionic columns—the beams covering the side aisles were 22 feet long, and those of the centre aisle 17 feet, with a proportional breadth and thickness. These enormous masses raised to the roof of a building standing on the summit of a steep hill, might well excite the admiration of ancient travellers. See *Athens*, *Propylæum*. The wings of the Propylæa were nearly symmetrical in front, each presenting on this side, a wall adorned only with a frieze of tryglyphs, and with antæ at the extremities. The great simplicity of the wings in this direction was characteristic of the work of defence, of which they formed so important a part, and the purposes of which regulated their construction. The flanks also in these bastions were uniform in their external appearance, each of them presenting a Doric front of three columns, in antæ of three feet in diameter supporting pediments, the summits of which were on a level with the frieze of the great Propylæum. The inner or southernmost column of each wing stood in a line with the great Doric columns of the Propylæum, and as both these columns and those of the wings were upon the same level, the three porticoes were all connected together, and the four steps which ascended to the Propylæum were continued also along the portico of the two wings. Here the uniformity of the building ended, for in regard to interior size and distribution the wings were very dissimilar.

In the northern wing, a porch 12 feet deep. conducted by three doors into a chamber, 34 feet by 26; the porch and chamber thus occupying the entire space lying between the western wall of that wing. The southern wing consisted of a porch or open gallery, 26 feet by 16, which on the east and south sides, was formed by a wall connected, and of the same thickness, with the side wall of the Propylæum; having its roof supported by a narrow pilaster, standing between the north-west column of the wing and an antæ, which terminated its southern wall. The wall thus appearing in front of this wing, and preserving the outside symmetry, formed a screen to the open gallery. between which and the screen there was a passage of four or five feet, leading into the citadel by a postern gate. The military defences of the Propylæum would have been incomplete without this postern.

The circumstance which principally appears to have regulated the Greeks in protecting the approach to their fortified places, was the undefended state of the Greek soldier on the right side of his body; while an ample shield covered the left of the Aoplita, all his right side was exposed to the missiles of the enemy. It may be inferred from the description by Thucydides, of the battle between the Lacedæmonians and Argives, at Mantinea, that this effect of the arms of the Greeks, was one of the chief regulators of the movements of their troops in the field of battle; but it was still more important, as a leading principle, in defending the approaches to the gates and vulnerable points of their fortifications, as Vitruvius instructs his readers, and as we find exemplified in a great variety of Greek ruins still existing in Greece, Italy, and Sicily. It often taught the Grecian engineers how to occupy their ground, and in many cases determined the general form of their fortifications; and it frequently regulated the construction of their gates, and the direction in which they were to be approached. In several Acropoles there are seen traces in the rocks of the ancient paths leading to the gates, where it is very evident, that the direction of the paths was contrived with a view to oblige the enemy in his approach to expose his right side to the rampart. It follows that the left front of a Greek fortification was more easily defended against the approach of an enemy than the right; and as the only approach to the Acropolis was by the ridge falling to the south-west, it was greatly favoured by natural situation; its right, which would otherwise have been the weaker side, is defended by steep rocks; while the ridge which slopes from the left, by obliging the assailants to move from that quarter, facilitates the formation of outworks, which would have the effect of obliging the enemy to mount the steep ascent under the continual disadvantage of exposing his right side to the besieged.

The plan, which is partly conjectural, will more fully explain the construction—the entrance-gate A, was completely commanded from the wall BC, of the Acropolis, and the soldier who was advancing to the attack, was obliged continually to expose his right side to the soldiers on the rampart. Having turned the point C, he again exposed his right side to that part of the rampart or platform above EF; and it is probable that while advancing to G, he was farther exposed to the missiles of the Athenians from a lower citadel or fort, meant to command or overlook the road beneath. If the enemy succeeded in turning this terrace by a passage at the end of it, he proceeded to the right, and advanced to the gate of the Propylæa, and thus would obtain possession of the outwork BE in reverse. The besieged would then be under the necessity of retiring within the Propylæa. In approaching the entrance of this building, the besieger was again exposed in front from the Propylæum, and on the other side from the wings IK; and here again his right was still more undefended, because the besieged in the southern wing had the power of retreat and reinforcement through the postern, which was placed at or near the gate L; this situation was thus so well secured and covered by the construction of the southern wing, that the postern still afforded the opportunity of endangering the rear of the besiegers.

The postern was therefore essential to the military defences of the Propylæa, and the inequality of the two wings, is not to be ascribed to any difficulties arising from the nature of the ground; for while the adorning of the citadel was the object of the architects, and their director Pericles, its details and plan were parts of an admirably-contrived system of military architecture.

This building was completed in five years, and is estimated to have cost nearly 480,000*l.* For its details, see *Propylæa.*

After the battle of Marathon, when success so often favoured the arms of the Athenians, and the state rose rapidly to dominion and to glory, Victory was then fabled to have been fixed by their tutelary deity Minerva to the Acropolis, by being deprived of her wings. In the Acropolis, therefore, they placed her statue and temple, which were erected from the spoils taken in that celebrated contest.

Of this little temple, of which there are now no traces on the spot, the figure V. is a conjectural elevation, by Mr. Cockerell, from an admeasurement of some detached fragments, lying in the Acropolis, and one or two fragments (which are supposed to have belonged to it,) at present in the British Museum It was seen by Spon and Wheler, who have given a few measurements of what then remained at their visit. It was used as a powder-magazine by the Turks, and destroyed in an accidental explosion.

On the steepest part of the ascent to the Propylæa, about 17 feet before the south-western angle of the northern wing of the vestibule, was placed a pedestal, supporting, it is supposed, an equestrian statue, having a corresponding pedestal and statue placed opposite the southern wing. The statues are conjectured to have been those of Marcus Agrippa, who was a great benefactor to the Athenians, and Caius Cæsar Octavianus, his colleague in his third consulship. The fine taste of the Athenians, it has been remarked, has been shewn even in the placing of these statues; the pedestal of M. Agrippa did not stand parallel to the front of the entrance-gate or vestibule, but its south-western angle was thrown a little back. "Undoubtedly," says an observer, (himself imbued with no small portion of that sagacity and fine taste, which he was noticing to be displayed by others,) "for the purpose of more advantageously exhibiting to those who ascended the hill, the statue which stood upon it."

Upon a minute inspection of several fragments of two pediments found in the ruins, it was discovered that some of the members of the cornice were gilt; on others an enrichment was painted in reddish ochre; in one instance, the form of the echinus moulding was slightly sculptured, for the purpose of assisting the effect of the painting; a mode of decoration not uncommon in Grecian buildings: it seems probable that the colour which was observed was the ground of gilding which has long perished.

After passing through the Propylæa, a descent of steps conducts to the grand platform or area of the Acropolis, on which was erected the *Parthenon*. The level of the rock on which it is founded is more than 30 feet higher than that part on which the Propylæa is built; so that the temple was so far elevated above the level of the western entrance, that the pavement of its peristyle was upon the same level as the capitals of the columns of the eastern or inner portico of the Propylæa. This temple was begun and finished under the government of Pericles, and is justly esteemed the "Pride of Athens, and the boast of Architecture." In whatever direction Athens is approached, it forms a splendid and magnificent feature in the landscape. It was built under the architect Ichinus, to whom some have added the architect Callicrates.

The platform is elevated three steps above the surrounding ground, and the area embraced by the uppermost steps is little more than 227 feet in length, and 101 in width.

There were eight columns in the portico of either front, and 17 in the flanks; these columns were 6 feet 2 inches in diameter, and 34 feet high. From the epistylium of the eastern, or principal front, were probably suspended shields of gilt metal, in conformity with the practice observed in the temple of Jupiter at Olympia. The total height of the temple being about 65 feet.

Within the peristyle, at either end, there was an interior range of six columns of 5½ feet in diameter, forming a vestibule to the door of the cella or *adytum*;

these vestibules were ascended by two steps from the peristyle.—The cella, 62½ feet broad within, was divided into two unequal chambers, of which one was nearly 44 feet long, and the other about 97½ feet long. The ceiling of the smaller chamber was supported by 4 columns, and of the larger by 16 columns; the order of these interior columns is unknown, as all traces of their ornaments appear to have perished; even their existence can be but conjectured, by means of the construction of the pavement, and by a trace of *one* of the columns in either chamber.

The existence of these internal columns is not however admitted by Wilkins, who made a very minute inspection of the building in 1801. Under *Parthenon*, his arguments in favour of this supposition will be stated at length.

The metopes were enriched with sculptures, executed in high relief; the subject, a series of combats between one of the Lapithæ and the Centaurs: in the tympan of the pediments were sculptured groups of a colossal size, many of the figures being perfect *statues, wholly detached from the tympanum, and sculptured all round.*—The circumstances attending the birth of Minerva were represented over the one entrance, and also the contest between the goddess and Neptune for the *honour* of presiding over the affairs of the city; for the Athenians, in choosing a tutelary deity, did not omit the opportunity of paying a compliment to their national vanity.

Behind the columns of both fronts was another range of columns, of lesser dimensions, advanced before the antæ of the pronaos and posticum, contrary to the usual Greek practice; and the area of the pronaos and of the posticum was elevated two steps above the level of the peristyle.

The entablature or frieze of the inner range was continued along the side-walls of the temple, and enriched with sculptures executed in bas-relief; it was not broken by the insertion of triglyphs: but in the epistylium, the guttæ, or drops, are introduced in the same manner as when the usual insertion of triglyphs was made. This afforded an opportunity for an uninterrupted representation of the grand procession which took place at the celebration of the Panathenæan festival.

The transverse walls, terminating the pronaos and posticum, receded 12 feet behind the columns of the interior ranges, and doorways of ample width and height were left in them for the approaches to the cella.

Stuart imagined the Parthenon to have been of that description of temples called Hypæthral, or those of which the cella was divided into three aisles, of which the two next the side-walls were covered with a roof, and the middle aisle left open to the sky.—The researches of recent travellers having thrown additional light on this subject, his opinion is no longer tenable, and the passage in *Vitruvius*, which was considered to allude to this temple, has been shown to be a corruption of that author's text. There were no columns in the cella of the temple.

The roof was unquestionably of timber, and covered with marble, sculptured so as to represent large tiles, after the model observed in the Temple of Jupiter at Olympia.

Some of the blocks of stone of which the Parthenon is composed, are so closely fitted, that no separation is visible; and in some instances, where the adjoining fragments of two contiguous stones have broken off, they adhere almost as firmly as though they had never been disjoined; this cohesion is, however, only observable in the *vertical* joints: the separation between the horizontal beds of the blocks is far more conspicuous.

The want of cement was amply supplied by the liberal use of *iron cramps;* in a block of four feet in length, three cramps are sometimes found connecting it with the next adjoining. One set of cramps being used for connecting the stones of the same bed together, and the other for connecting the superincumbent courses: the first, which united the blocks both at the end and at the sides, resembled the letter H, protracted so as to be from 11 to 15 inches in length. The others were plates of iron, 5 inches in depth, 3 in width, and three quarters of an inch thick. They were usually inserted half their depth into the stones beneath the vertical joints of the next superior course, the other half remaining to be received into a groove made across the common joint of the two blocks meeting above it. Holes of the same form, but of greater dimensions were sunk for the reception of the first sort of cramps, the space being filled around with melted lead; lead was only used in fixing the second sort of cramps in the horizontal courses, but no means appear to have been employed for its introduction at the angles of two blocks, whose vertical joint is immediately above them.

The stones composing the shaft of each column were held together by round pins of wood; *square* sockets of the same material were first sunk in the centre of two adjoining blocks, the socket of the lower course received half the pin, and the other half projected into the socket in the upper stone. The pins which have been found, appear to have shrunk very considerably; besides these, there were usually two metal plates, of the kind already mentioned, inserted in these blocks composing the column, as in the other part of the building.

North of the Parthenon stands the *Erechtheum*, a double temple of the Ionic order; its size, compared with that of the Parthenon, is small, but its details and composition are equally beautiful.

This temple was built over a salt-spring or well, and was probably a spot consecrated to the gods earlier than any other in Athens. It was the burying-place of Erechtheus; and enclosed an olive tree, an object which was held in great veneration by the Athenians.—The present remains form part of the temple raised during the dominion of Pericles.

The Erechtheum consists of two temples: one of them dedicated to Minerva Polias, and the other to Pandrosus. The whole erection is sometimes called the Temple of Minerva Polias, from its being the more important of the two buildings. The wooden statue of the goddess, which was here worshipped, was considered the most holy of any in Attic land, and was especially venerated by the Athenians as being the peculiar protectress of their Acropolis. The floors of the cellæ of the two temples were not upon a level, that of Minerva Polias being elevated 8 feet above the Pandroseum.

The Pandroseum is formed of two chambers, of which the western is narrow and opens into a portico at either end; the northern portico being formed of six Ionic columns, and the southern portico, instead of columns, has its roof supported by six female figures called Caryatidæ. The porticoes of the temple were approached by a descent of steps, and within it was preserved the sacred olive; The Caryatic portico is thought to be a building mentioned in old Greek writers, and called the Cecropium.

Besides these temples, the remains of which are still in existence, ancient authors enumerate the temples of Jupiter Polieus, Pandion, and to Rome and Augustus, the Hierum of Venus Leæna. which contained the brazen lioness, and the statue of Venus by Calamis; the Diitrephes, the two Hygeiæ, the Aspergillifer by Lycius. and Perseus slaying Medusa by Myron; between the temple of Diana and the Parthenon were the Trojan horse, the Epicharmus, the Ænobius, the Hermolycus, the Phormio, Theseus and the Minotaur, Apollo flaying Marsyas, Phryxus sacrificing, Hercules slaying the serpents, Minerva rising from the head of Jupiter, the bull dedicated by the Areopagus. Not far from the temple of the genius of pious men stood the warrior with silver nails, by Cleoetas, Earth praying for Rain; then the statues of Timotheus, Conon, Procne and Itys of Alcamenes, the contest of Neptune and Minerva, Jupiter by Leochares, and Jupiter Polieus. In front of the Parthenon, towards the east, stood Apollo Parnopius by Phidias, the Anacreon, and the statues by Deinomes, of Io and Callisto. On the eastern extremity of the Acropolis were the Olympiodorus, the Diana Leucophryne, and the ancient statue of Minerva by Eudocus. On the opposite side were the half-burnt figures of Minerva, the statue of Lysimacha, and the colossal group of Erechtheus and Eumolpus; near or between these were the hunting of the wild boar, Cycnus and Hercules, Theseus discovering the sandals, Theseus subduing the bull; the Cyclon, and a brazen colossus of Minerva by Phidias. Near the entrance of the Propylæa were a statue of Pericles, and a statue of Minerva Lemnia by Phidias. Besides these were a statue of the mother of Isocrates, of Isocrates himself, Mercury (surnamed the Uninitiated). a brazen ram, compared for its colossal dimensions to the Trojan horse, Daraus, a statue of the Emperor Adrian, a Minerva by Nicias, a statue of Demetrius of Phalerum, an ox by Lysias, a horse dedicated by Diphilus, upon occasion of his being made a Roman knight, and numerous portraits of Grecians of no great note; but besides these, the servility and flattery of the Athenians had crowded the citadel with statues of powerful Romans.

Chandler supposed the Acropolis also to have enclosed streets of houses; but such an arrangement would have been at variance, as well with the fine taste, as with the religious prejudices of the Athenians. In justice to both, we must consider the *entire platform* of the Acropolis as a splendid composition of architecture and sculpture, and as "a single superb monument or magnificent dedication to the gods."

The walls of the Acropolis are built at the extreme edge of the precipice, and are about 2500 feet in circuit; the length from the south to the northwest angle about 1150 feet, and its greatest breadth 500 feet, forming an irregular polygon; the height of the rock may be about 150 feet from the plain, composed of a stone of a calcareous and friable quality, and of a deep ochreous tint.

From the Pelasgi, who are said to have been the first inhabitants of the plains, the citadel sometimes received the name of the Pelasgic fortress; and from a tradition of Cecrops. the first king, having here founded the city, it was also called the Cecropian Hill. In progress of time, as it increased in importance, the houses stretched into the plain, when the distinction of the lower and upper city, or Acropolis, took place, until, in later times, the platform of the Acropolis was appropriated solely to the uses of the citadel.

Who first surrounded the Acropolitan platform with a wall, is unknown, but it is probable that the work of Pelasgi may be traced in part of the boundary wall, from a division of it having received that name by tradition. It is certain, however, that the walls had fallen into decay at the period of the first Persian war; for it was then necessary to repair them with palisades; that the ancient walls had been constructed with care, and in the manner usual in military erections, appears highly probable from a passage in Thucydides:—he describes the fortifications to have been restored, after that war, in great haste, (and by inference, in an inferior manner to the old wall), and says, "the foundations were built of stones of every shape and size—not fitted to one another; and the wall is full of sepulchral columns; and of wrought stones from former buildings, united together."

Cimon appears to have restored and re-established those parts of the walls which the Persians in their second inroad under Mardonius, had thrown down. Those which were demolished by the Spartan Lysander, were rebuilt by Conon, and after the battle of Chæronea they were repaired by Demosthenes. Philip, son of Demetrius, of Macedon, with unsparing vengeance, also appears to have destroyed a great part of the enclosure; and Sylla completed this so effectually, that they lay in ruins for nearly three hundred and fifty years afterward,—when they were again rebuilt in the reign of Valerian and Gallienus, and also afterwards repaired by Justinian.

Notwithstanding all these dilapidations, it is probable that a considerable portion of the walls at this moment forming the enclosure, are part of the works existing from the period of first reparation; a part of the northern side bears the strongest evidence of having been part of the work erected in the time of Themistocles.

The *upper* part of the present wall is the work either of the Venetians or Turks,—the buttresses are the additions of a recent period. The lower parts are composed of large rectangular blocks of stone, without any remains of what has been called polygonal building.

The Acropolis was lately used as a fortress by the Turks, but all its statues and decorations have for ages disappeared. The Parthenon was converted into a Greek church, and the ancient roof having perished, it was covered with a roof and cupola in the usual manner. At the siege of Athens, in 1676, by the Venetians, the explosion of a shell, fired by the besiegers, nearly destroyed half of the fabric, and the walls of the Cella were almost totally levelled, and five of the columns of the pronaos — eight columns on the north side, and six on the south side, were also at this disastrous time thrown down.— The shell appears to have exploded in nearly the centre of the Cella, or Adytum; many of the masses were carried to a considerable distance beyond the building. The columns of the eastern portico suffered nothing, but the pediment and its sculptures were almost wholly destroyed: one of the principal groups which remained, after the citadel surrendered, was shattered to pieces in the attempt of Morosini, (a Venetian barbarian who accompanied the expedition,) to displace it, for the purpose of transporting it to Venice. What was then unhappily begun, has been since nearly completed. The British Museum possesses the greater part of the sculptures which once adorned its metopes and pediment; and, what with the influence of the seasons, and the operations of petty spoilers, the temple is rapidly approaching total annihilation.

The columns of the Propylæa are disfigured, and their fine proportions are lost, by an accumulation of rubbish—of the columns supporting the marble ceiling, only some of the shafts remain, the capitals and ornaments have perished; every thing is buried by the ruins, which have risen about eighteen feet above the original level, and vaults and prisons have been constructed beneath the accumulation.

The Erechtheum has suffered more from wilful spoliation than even the Parthenon; one of the columns and its entablature is in the British Museum; only five columns of its portico and their epistylia remain; but mutilated, disjointed, and shaken, they cannot long resist the attacks of time, and wanton, barbarous dismemberment: the wall towards the south is nearly level with the ground — the transverse walls have almost totally disappeared.

The Pandroseum, which, before 1801, was in a state of preservation that would have for ages resisted the attacks of the weather, has even suffered more than the Temple of Minerva Polias from the fangs of the dilapidator. Of the six exquisite caryatidæ one was wanting when Stuart visited Athens; and its place was ill-supplied by a pillar of modern masonry—another, in 1801, was removed by Lord Elgin, which has also found its way into the British Museum; and, as if the genius of the deepest and most unfeeling barbarism had guided his lordship's spoliation, the statue he selected was taken from a part of the building which has not only irretrievably destroyed the admirable beauty of the fabric, but also its stability.

"Every thing," says an eyewitness of the transaction, "relative to this catastrophe, was conducted with an eager spirit of insensate outrage, and an ardour of insensate rapacity, in opposition not only to every feeling of taste, but to every sentiment of justice and humanity."

"Independent of the moral blame which necessarily attaches to such an act," says Mr. Dodwell, "the authority of the example may be henceforth pleaded as a precedent, and employed as an apology for similar depredations. The Athenian Temples will probably be destroyed for their ornaments, which instead of remaining in their original places as the property of *all nations*, will be appropriated by the strongest.

"When we come to trace the causes which led to this scene of havoc and destruction, the greater share of the odium will naturally, and not unjustly, be referred to those who first exhibited the example of such unhallowed violations of all that the feeling of genius and taste respects and consecrates. We cannot also omit to observe, that had the temples been left untouched, and the sculpture only been removed which had already fallen, our National Museum would still have been enriched with sufficient specimens for the improvement of our national taste, while *casts* would have answered every purpose of those originals of which the temples have been sacrilegiously despoiled.

"It is indeed impossible," continues this accomplished traveller, "to suppress the feelings of regret which must arise in the breast of every traveller who has seen these temples before and since their late dilapidation; nor have I any hesitation in declaring that the Athenians in general, nay, even *the Turks* themselves, did lament the ruin that was committed, and loudly and openly blamed their sovereign for the permission he had granted. I was on the spot at the time, and had an opportunity of observing, and indeed of participating in the sentiment of indignation which such conduct universally inspired: the whole proceeding was so unpopular at Athens, that it was necessary to pay the labourers more than their usual profits, before any could be prevailed upon to assist in this work of profanation.

"During my residence at Athens, the work of devastation, having been begun by the Christians, was imitated in an humble manner by the Turks. and a large block of the epistylia of the Erechtheum, at the south-west angle, contiguous to the Pandroseion, was thrown down by order of the Disdar, and placed over one of the doors of the fortress. I imagined that he intended to demolish the other parts of this elegant edifice, which seems doomed to destruction. I took the liberty of remonstrating on the impropriety of his proceedings — he (a Turk!!) pointed to the Parthenon, to the Caryatid Portico, and to the Erechtheion! and answered with a singularly enraged tone of voice, 'What right have *you* to complain — where are now the marbles, which were taken by *your* countrymen from the temples?'"

Whatever feelings of satisfaction therefore may be experienced at these having become the property of the nation, the deepest execration ought to follow the dismemberment of these exquisite buildings, for a purpose so sordid and mercenary as that which seems to have influenced Lord Elgin — mutilated in his own person, he seems to have delighted in mutilating those remains of Athenian glory and magnificence, which for twenty-two centuries the Romans, the Vandals, the Huns, the Venetians, and the Turks had spared!

The ACROPOLIS of TIRYNS is the best specimen existing of the mode of building fortresses in the heroic ages. It was surrounded with walls in the time of Homer, who calls it the "walled or fortified Tirynthus."

The ruins which are now seen are considered to be those which existed in the time of the bard, and were built by Prœtus about 1376 years before Christ.—The Acropolis is built on a small mount about fifty feet above the level of the plain, and the foundations of the enclosure are still perfect. The ancient city is supposed to have surrounded the fortress; and that the sea formerly came nearer to its site than at the present day; being now nearly fifteen minutes (journey) distant.

The plan of Tiryns (figure V.) is compared to that of a long ship, and the ingenious Mr. Bryant supposes that in fact its type was the long ship of Danaus.

Towards the east of Tiryns rise some barren hills, the quarries of which furnished the stones for the Tirynthian Acropolis.

The Acropolis had entrances from the east, from the west, and one at the south-eastern angle.

The eastern entrance (*a*. fig. V.) is still in tolerable preservation, and is approached by a sloping way (*b*), fifteen feet wide, along the eastern and southern sides of a tower (*c*), twenty feet square and forty feet high, passing at the end of the second side, under a gateway composed of immense blocks of stone; the stone forming the architrave being 10½ feet long.—It is thought that there was formerly a triangular stone above the architrave of this portal, forming a kind of pediment; the fragments are now lying on the spot, but without any appearance of having been sculptured.

The walls are generally 25 feet thick, and are formed of three parallel ranks of stones, 5 feet thick, which separate two ranges of galleries in the walls, each five feet broad and about twelve feet high—the sides of the galleries are formed of two courses of stone, and the covering of other two horizontal courses which project until they meet. (fig. VI.)

The *roof is pointed* when seen from below, the lower surfaces of the stones being cut at an angle of forty-five degrees. (figure VII.) That part of the gallery (figure IV.) which is now uncovered, is about ninety feet long, and has six openings or recesses towards the east, one of which is a kind of window or door, which probably communicated with some exterior building, of which there are still some traces of the foundation in existence—the space between these niches varies from ten feet six inches, to nine feet eight inches, and the niches themselves are from five feet six inches to four feet ten inches wide; these galleries were probably continued all round the citadel, but they are only accessible at present where the walls are least perfect (*m*, fig. III.), at the southern part of the enclosure. The galleries were probably constructed for shelter of the garrison in case of a siege, as no loop-holes or other openings, open from them into the plain, and which would have been the case, had they been constructed for any defensive purpose,—if the inner gallery received light from the arched area, the exterior must have remained almost dark. No remains of the south-eastern portal remain; it appears to have been connected with the eastern gate by an avenue enclosed between the outer wall and the inner curtain; yet it is not easy to conjecture the use of this singular place,—others, of a similar kind, are met with at Argos, and in some other ancient cities of Greece.

The walls of Tiryns and Mycenæ, are the finest remains of Acropolitan building in Greece, but they are inferior in magnitude to erections, (called Cyclopean), of

Norba, in Latium; and several other Pelasgic fortresses of Cora, Signia, and Alatrium, in Italy, (the walls of which resemble those of Tiryns, Argos, and Mycenæ,) whose wonderful ruins exhibit walls of equal strength and solidity with those of Argolis.

The northern point of the hill is less elevated than any other, and its wall is composed of stones of a smaller size than those employed in the galleries. All the exterior walls are composed of rough stones, some of them nine feet four inches in length and four feet thick; their usual size is from three to seven feet. The wall, when entire, must have been about sixty feet high. On the eastern side the wall has been entirely destroyed, probably by the Argives, about 460 years before Christ, that the city might be left entirely unprotected.

There is a small entrance-gate in the *pointed* form, six feet one inch wide, situated in the recess of the western wall; it is defended by a wall *projecting in a curve.*

The whole length of the citadel is about 660 feet, and the breadth about 180 feet, and the walls are constructed upon a straight line, without any reference to the sinuosities of the rock.

Pausanias (Corinthiac[illegible] chap. ii.) states a tradition that "the hero, Tirynthius, from whom the city was also denominated, was the son of Argus, and the grandson of Jupiter; but the wall, which is all that is left of the ruins, is, according to tradition, the work of the Cyclops. It was raised from rude stones, each of which is so large, that the least of them cannot be raised out of its place by two oxen yoked together; but formerly small stones were inserted, that each of them might harmonize as much as possible with the greater ones." Pliny says that Thrason first constructed the walls of cities,—the Cyclopeans, according to Aristotle, first built towers and forts; but Theophrastus attributes the latter invention to the Tirynthii.

Tiryns was either built by Prœtus, or then first became a royal residence. It is mentioned by Homer first amongst the cities of Greece, in possession of the art of conveying thought by letters or symbols. Hercules lived some time at Tiryns; the Tirynthians are mentioned by ancient authors as being immoderately addicted to laughter.

The Acropolis of Mycenæ appears to have been constructed by the same people who built Tirynthus. Homer says, the town was "well built," and its walls "heavenly." Perseus, according to Apollodorus, fortified Tiryns, Mideia and Mycenæ. In the time of Pausanias, a part of the walls was visible, and *a gate* on which were sculptured two lions; the same gate now remains nearly in the same state as when he described it, 1600 years ago; the lions over the gate are still in their original position, and are now probably the only specimen of the sculpture of the heroic ages in existence.

The gate (fig. IX.) is situated at the end of a recess, about fifty feet deep, commanded by projections of the walls, which are in this part composed of huge blocks of squared stones, but they are often placed exactly one above another, so that the *joints* of *three* or *four courses are in one perpendicular line*, which gives a strange and barbarous appearance to the whole. The architrave consists of a single stone, fifteen feet long, and four feet four inches high.

To the south of the gate of the

lions, the wall of the citadel is much ruined. In one part, something like a tower is visible, which being *perpendicular*, while the curtain *inclines a little inward from its base*, there remained a projection at the top sufficient to enable an archer to defend the wall below. The blocks of the superstructure are in general of great size, while those of the foundation are much smaller.

This mode of building is observable in all the very early fortifications of Greece. With the exception of the gates, the whole circuit of the citadel is built of rough masses of rock, very nicely adjusted and fitted to each other, though the smaller stones, which filled up the interstices, have generally disappeared; this style of building has commonly been called Cyclopean:—it certainly appears that the walls of the most ancient cities of the Peloponnesus, whether attributed to the Cyclops or not, were of this construction. Tiryns and Mycenæ differ from other acropoles in their galleries and gates, so that, perhaps, the ponderous method, which so nearly resembles the style used by the Egyptians, of which the gate of the lions is the best specimen in Europe, is the real Cyclopean, while the remainder of the circuit is the work of the natives.—These fortifications were reputed to be impregnable, and were so in ancient times. At the siege of Mycenæ by the Argives, these warriors found themselves unable to destroy the city, but they forced the inhabitants to surrender through famine. Mycenæ was demolished by the Argives at the time of the destruction of Tiryns, the buildings were overthrown, and the city for nearly 3000 years has been desolate.

The southern ramparts of the citadel, and all the other walls, follow the natural irregularity of the precipice on which they are founded. At its eastern point it is attached by a narrow isthmus to the mountain. It is a long irregular triangle, standing nearly east and west; the walls are mostly constructed of the second style of well-jointed polygons, although the rough construction is occasionally seen.

So small a fortress appears unworthy of the Tirynthian hero; but though the space which it occupies is so circumscribed, the walls are truly Herculean; their general thickness is 21 feet, in some places they are 25; their *present* height, in the most perfect part, is 43 feet. In some places there are square projections from the walls in form of towers, but the projection is very slight; the most perfect of these is at the south-east angle; its breadth is 33 feet, and its height 43 feet.

The block on which the lions are sculptured, is 11 feet broad at the base, 9 feet high, and about 2 feet thick, of a triangular form, filling the niche made for its reception.

The construction of the lateral walls is nearly regular, differing from the walls which constitute the peribolus or boundary of the Acropolis, which are irregular polygons; they are of the hard breccia stone, found on the spot; but the block ornamented with the lions resembles in its appearance the green basalt of Egypt. The back or inner part of the gate of the lions is highly interesting, as it exhibits two styles of construction totally differing from each other; that side which is towards the plain of Argos, is of the rough Cyclopean masonry, while the other side is regularly constructed like the front of the gate, and two lateral walls, which diverge from it. It would appear that the gate had been made some time after the original Cyclopean structure. Without presuming to decide whether the regular as well as the irregular, or polygonal construction, were not sometimes employed at the same period, there are indeed reasons for believing, that while the walls of acropoles, or citadels, and other strong places, were composed of Cyclopean masonry, the temples, sepulchres, and sacred edifices, were formed of a more regular construction, as the former were principally adapted to resist the impulse of warlike engines, while the sanctuaries of the gods, and the chambers of the dead, were regarded with reverential awe even by enemies.

A magnificent wall, composed of irregular polygons, closely united and carefully smoothed, supports the terrace on which the gate of the lions is situated.

The area of the Acropolis is a long irregular triangle, standing nearly east and west.

On the northern side, the declivity is also very steep, and there is a gate which consists of two stones, covered by a third. The opening is five feet eleven inches wide at bottom, and five feet, four inches at top. Above the architrave is a large stone, approaching the form of a triangle, with which the ruin is about fourteen feet high. The gates folded, and were secured by bars. The access to this entrance was by an artificial terrace, which was completely commanded by the wall: a curtain, nearly in a right line, extends from this gate to that of the lions; and it is very probable, that certain holes in the earth above this wall, which are shewn by the natives as cisterns, are actually connected with galleries similar to those of Tirynthus. After entering the gate there was a road commanded by a wall, which traversed the hill almost to the opposite side before it turned to the summit—so that the Acropolis was defended by at least a triple enclosure: on the northern side is a small gate, with its lintel entire. The structure is so disposed, that those who entered it would have their left arm, which was guarded by the shield, on the side of the Acropolis, which is a deviation from the common rule followed in constructing ancient Greek fortresses of all ages. The grooves for the bolts in the jambs of the door, are of large dimensions.

A deep rocky glen separates the Acropolis from the neighbouring hill: there was *anciently a bridge* over the ravine—one of the *side walls* still remains, consisting in *well-jointed polygons.*

The Acropolis of Plateæ was placed on an elevation of a moderate height, and from the few remains at present existing, these appear to have been constructed in the rude Tirynthian style.

There are several remains of the walls of the ancient acropoles of Argos, consisting of the second style, or well-jointed polygons, but not the slightest traces of the *rough Tyrinthian* style; and it is next to impossible that, had any part of the works ever been built in this style, that they should have so completely disappeared that not a single stone of it is at present visible: the walls in existence are those which are attributed to the Cyclopeans. The walls encircle the summit of the Acropolis, and the modern castle, composed of bastions and towers, built with small stones and mortar, is erected on the ancient remains, in which the lower parts of some round and square towers are visible. Argos had a second citadel or fortress, but of which there are no remains in existence.

Of the acropolis of Cyparissiai, two entire gates are remaining, of the common square form. One of them is almost buried under the ruins and earth, which reach nearly to its architrave. The towers are *square*—one of them is almost entire, and contains a small window or arrow-hole—a transverse wall is carried completely across the Acropolis, by which it was anciently divided into two parts—the foundation of this wall and part of the elevation still remain.

Three different styles of building are evident in this fortress—the walls are composed of polygons—some of the towers consist of irregular, and others of rectangular quadrilaterals.

The walls of the Acropolis of Thorikos, are all of an inferior kind of white marble veined with grey—which is found on the spot—though not in the Cyclopean or polygon style; they are, nevertheless, systematically irregular, and the stones, though generally quadrilateral, and placed in horizontal layers, are of various dimensions, and their angles seldom rectangular.

In the walls of the Acropolis of Akraiphnion, are the remains of a small gate, diminishing slightly towards the top, but without its lintel. The walls of the city were of the third style of construction.

The ruins of the strong hold at the pass of Thermopylæ, are in the fourth style of Acropolitan building. Their general thickness is seven feet; in some places they are constructed with small stones and mortar, where their thickness is more considerable.

The walls and square towers of the Acropolis of Chaëroneia, are in some places well preserved—and their style, which is nearly regular, renders it probable that they were constructed not long before the invasion of the Macedonians. Within the enclosure, there is a *projecting* wall which has been built to support a terrace, a singular remain; as in all other parts of Greece, the terrace walls are straight.

At Drymaia, the walls of the citadel are eight feet and a half thick, and in the third style, which is the usual manner in that part of Greece. They are well preserved; some of the square towers are nearly perfect, and are of a more irregular style of masonry than the other parts of the walls. The lateral walls lead from the base of the hill to the summit of the acropoles, where they almost meet in a point, forming nearly an equilateral triangle, which is the plan of most Greek cities having an Acropolis.

At Panopeus, the walls exhibit the three last styles of Greek masonry, although polygons are seen only in a few places: many of the stones are twelve feet long. The square towers projecting from the walls, are probably of a later date. Several of them are very perfect, and contain doors and windows of the usual form, diminishing towards the top.

The Acropolis of Eleutherai is situated upon an insulated rock, steep on all sides, and in some places precipitous; and appears to have been designed for the protection of the pass between Bœotia and Attica. The form of the enclosure is oblong, and runs nearly east and west; its entire length is about 360 yards, and its greatest breadth about 110; the walls are very perfect, in the style of those of Mantinea and Messene, fortified with square towers at unequal distances, projecting from the walls—many of them are nearly entire; they were divided into *two* stories, each of which had two rooms, at least the upper story, which has two entrances from without, and three small windows; the lower story has only one door, which is three feet and a half wide at the base, diminishing upwards; the walls are five feet and a half thick, and the inside space of the towers is fifteen feet square; the boundary walls are eight feet thick, pierced by several doors; of one, the prostomia, or opening, was four feet two at the base, and three feet eight at top, the lintel was seven feet long; this fortress had four entrances.

The walls of Palaio Kastro at Aito formed an irregular triangle, at one corner of which was placed the Acropolis, a figure preferred, from its convenience, in the construction of many Grecian cities, which occupied, like Ithaca, the side of a hill. There are no traces of towers projecting from the curtain of the city walls; it seems, however, probable, that the walls inclined inwards towards the top, leaving towers, as in figure 7, this, however, was only near the gates. The walls of the Acropolis shew some traces of towers on the south side, but they project within, and not in front of the curtain.—(See *Cyclopean* building.)

From the preceding enumeration of Greek Acropoles, whose walls are partly to be seen, it appears that among their vestiges four different modes of building were practised by the Greeks, at various periods, in military works as in their civil erections—the most ancient and simple being that in which immense masses of rocks, detached from the mountains, are piled upon each other; their shape being uneven, they could not be united so as to form a compact body; smaller stones were therefore inserted between them, in order that the building might be rendered more solid and secure. The walls at Tiryns are of this class, and also those at Mycenæ; but those at Mycenæ are probably not quite so ancient as those of Tiryns, for the sides of the stones with which they are built are in some degree squared and adapted to each other—the masses of both are great, some of them containing 216 cubic feet; these walls more resemble the works of giants than men, they are called Cyclopic, or Pelasgic works, by which we must understand nothing more than that they are constructed of large masses, in reference to the fables of the Cyclops, who were said to hurl rocks instead of stones. This mode of construction is however rare in Greek Acropoles.

The second mode of building in the Hellenic fortresses is that wherein smaller stones are used of a very irregular size and figure, and differing from each other, but the surfaces of each grooved and adapted to one another with the greatest nicety and truth—sometimes the pieces had seven or eight sides; in one instance, a piece, having thirteen sides, has been noticed—instead of being placed in their beds in the wall, rough as they came from the quarry, the masons worked the stone according to the shape in which it happened to be detached from its native rock into straight and smooth lines and sides, so that when joined together they produced a mass of masonry of great stability; perhaps, the *polygonal blocks are all posterior to the siege of Troy, and the Cyclopean masonry anterior*—the polygons found at Mycenæ are owing probably to subsequent repairs. In the third mode of building, the stones were placed in horizontal courses, but occasionally by descending below, or projecting above the general line of the course, they varied from regularity. The joints were sometimes at an *angle with the horizon*, and sometimes perpendicular.

The first mode is peculiar to Tiryns and Mycenæ. The second and third are observed indiscriminately in the fortified places of Greece Proper, and in the Peloponnesus.

In the fourth mode, the stones were parallelopipedons, squared on five sides, and laid in horizontal courses. In these, no cement or any other composition was used to unite the masonry—in the greater number of Greek Acropoles the stones have no other bond but their own elaborate workmanship; yet the walls and towers present the firmness and solidity of a rock, three thousand years after their erection. Phyle, in Attica, is mostly built in this manner. It is situated upon a hill inaccessible on two sides, of an oblong form, the narrow sides facing the east and west; its length is about 170 yards, and its breadth nearly ninety, and had two entrances, one on the east and another on the west. At the north-east angle is a round tower, on the opposite angle a square one, and another of the same form on the north side, projecting from the walls. Twenty layers, or courses of blocks, are still seen in some parts of the walls; they are generally parallelogrames, though the system of acute and obtuse angles, which seem to have been disused about the time of Alexander, may be occasionally remarked in this building; the date, however, of the foundation of Phyle is unknown.

The walls of Byzantium and Jerusalem are described by Herodian and Josephus, as constructed in a similar manner, the stones of a rectangular form were so adjusted to each other as to present the most regular surface. Very great care was paid by ancient military architects, of almost every country, to erect their Acropoles and city walls in this smooth and firm mode of building—because the fortresses were better able to resist the sharp points of the catapultae and battering engines which were impelled on the walls, where a breach was desired by the besieging party.—(See *City*, *Cramps*, *Cyclopean Building*, *Fortress.*)

In this style were the fortifications of Plateæ. Thucydides says, the fortifications of the Acropolis were protected by a *fosse* or ditch. Yet such was the simplicity of the means used for securing these ancient strong holds, compared with the complicated works of a modern fortress, that when the Thebans, after their vain attempt to surprise the city, were endeavouring to effect their escape, they cut the wooden bolts of the gates asunder—a woman having lent them a hatchet for that purpose.

Tithoniai is a square structure built in the Cyclopean style, with large masses of stone, but laid together with great evenness and regularity, although without any cement, the work not being so ancient as that of Argos, of Tiryns or Mycenæ. The walls of the city, fortified by *mural turrets*, are of the third and fourth styles; the towers are in good preservation, approaching to the regular construction, and are no doubt less ancient than the walls. Each tower has two doors, and two rows of windows of the usual form, diminishing towards the top. The interior of these is nineteen feet eight inches square, originally of two stories; the holes that received the *beams* are seen in the walls above the lower range of windows.

Very few traces remain of the original walls of the city—but some parts of those restored are in good preservation. These parts are composed of regular masonry, with some accidental irregularity in the size of the stones, but which does not appear to be systematical. They are about eight feet thick, fortified by square towers, with a few of a circular form; they are ornamented with *perpendicular* stripes, similar to those of Agia Euphemia in Locris, and which occur in most of the walls of this period.

In those of Agia Euphemia, equidistant towers extend round the town, the steps up to many of them remain. The blocks composing the walls are ornamented and cut with *parallel perpendicular lines*, as in many other parts of Greece: an ornament still used, particularly in Italy; the lines are sometimes *horizontal.*

Acroterium, (*Akroterion*, Gr.) the extremity or vertex of any thing. A pedestal, or base placed on the angle, or on the apex of a pediment.

The Greeks placed ornaments upon the acroteria of the angles of a pediment, and also figures, generally small, of bronze, or some metal gilt.

The Megarenses, who dwelt in Attica, built a treasury, and in it they placed "images made of cedar, and painted with gold, so as to resemble flowers and other ornaments—the battle of Hercules with Acheloüs, &c. About the top (or tympan) of the pediment was represented the battle of the gods and giants; and on the *apex*, or middle acroterium, they placed a *shield*, with an inscription, relating that the building was erected by the Megarenses, from the spoils taken by them from the Corinthians."

Over the Corinthian propylæa were placed *two* brazen chariots, gilt, one of which "bore Phaëton, the offspring of the Sun—the other, the Sun himself."

The Temple of Jupiter, at Olympia, built of the stone of the country, after the Doric manner, under the direction of the architect Lihon, had brazen *vases* on the lateral acroteria, and the centre one supported a golden *statue* of Victory, on the shield of which was sculptured the head of the Gorgon Medusa, and also bore an inscription, naming the persons who dedicated it, and the occasion of its erection.

Acroteria were placed at the angles of the pediments of the Parthenon, and from the remains at this day, exhibiting the marks of cramps in their upper surface, it is evident that they must have supported some ornamental termination.

"It does not seem improbable, that the ornaments upon the acroteria of the Parthenon might have been vases of a similar description; the custom of placing them in such situations, appears to have been common amongst the nations of antiquity. In this situation, they might probably have had some allusion to the prize bestowed upon the conquerors in the games which took place at the Panathenaic festival. It is not unlikely that the Parthenon was the temple alluded to in a fragment of Callimachus, to which the scholiast upon Pindar refers. The vases he speaks of, were placed upon the summit of the temple."

The acroterium of the propylæum of the Agora, at Athens, still remains, and bears an inscription, implying that it formerly supported a statue, or some trophy decreed by the Athenians to Lucius Cæsar, the adopted son of Augustus.

Stuart (Antiquities of Athens, vol. I.) supposed the acroteria usually supported statues; and that, in this instance of the Agora, there was ground for believing that the centre acroterium, from its large size, was adorned with an equestrian statue of Lucius Cæsar, and that the lateral acroteria also supported statues, probably of individuals of the Augustan family.

This opinion is, however, questioned by some later authors, who have had the means of inspecting the building—and one argument adduced, among others, for Stuart having been mistaken, is the fact, "that wherever the ornamental decorations of the acroteria have been discovered, they are invariably of diminutive proportions. And if the trophy is supposed to have been a Victory personified under the figure of a winged genius, drawn in a triumphal car, it will be more consistent with the practice, both of the Greeks and Romans."

The use of the ornament for tombs is conjectured by Sir William Gell to have had a different origin besides that of mere imitation.

"The little acroteria, in some instances bearing bassi relievi, and which are so frequent about the tombs of Pompeii, are curious—some tombs remaining in the necropolis, or burial-ground, of the ancient city of Cnidus, are ornamented in a similar manner. Places of sepulture were originally surrounded with a fence or paling of wood; the standards at intervals, so necessary for its stability, were possibly the prototypes of these pinnacles, and from them were probably suspended the garlands and wreaths, with which, at stated periods, the sepulchre was adorned."

From the pediments of buildings, the acroterium became a common ornament in altars, *&c.*, and for decorating the angles of the abacus. The forms given to them were numerous, but it is seldom (not more than three or four examples of exception occur to our recollection) that they appear to have been destined to support any thing. *Garlands* are often seen suspended between them, which may have an allusion to the custom of adorning the urns or cippi at stated periods, by the relations of the deceased, with wreaths of flowers.

In the engravings which illustrate the word *altar*, various examples of acroteria are given.

Among workmen, *decorated acroteria* are very generally called *asses'-ears, or dogs'-ears,* from a supposed resemblance to those parts, in their outline and situation.

Vitruvius says, that the lateral acroteria ought to be half the height of the tympanum, and the apex-acroterium should be an eighth part more. In Grecian buildings, any regular proportion is not observable. The word, in old writers, is sometimes used for the ornaments placed on the acroteria; and for the *pinnacles*, or other ornaments, which stand in ranges on the horizontal copings or parapets of buildings.

Acroters. See *Acroteria.*

Acrostolium. (*Akrosolia*, Gr.) *In ancient naval architecture.* The ornament of the extremity of the prow, or forecastle of a ship. The entire ornaments of the prow were called solos, acrostolium being limited to the terminating ornament. Corymba designated ornaments of every kind, used in naval decoration. To the acrostolia may be referred those polished steel pieces resembling a duck's neck, used by the Venetians in their gondolas.

The favourite emblem of each particular people, rarely failed to make its appearance as the acrostolium ornament in vessels, both for commercial and state purposes. The owl was conspicuous on Athenian galleys; the cock, emblematical of vigilance, on those of the Phœnicians; a goose, or a swan's head, was a common termination of the prow; or a shield, or helmet, and an ornamented scroll is often seen to be used for this purpose.

The acrostolium was usually made of metal, polished or gilt, in national vessels, and it appears to have been further decorated with paintings, as is common in ships at present.

The plate entitled *Acrostolium* contains a collection of ornamental prows taken from ancient medals; the names under which they are ranged, are those of the countries to which the medal has belonged. Those marked Trajan and Antonine, are from the sculptures which adorn the triumphal columns of these emperors, still to be seen at Rome. In the plate, marked *Naval Trophies*, other examples, as parts of *architectural decoration*, will be found. The acrostolia of vanquished enemies were torn from their prows, and fastened on that of the victor, as a signal of triumph.

Actuariæ Naves. *In ancient naval architecture.* A description of long light ships, deriving their name from being constructed for the purpose of swift sailing; they answer to what the French call brigantines: they were propelled by oars.

Acute-angled Cone, a cone whose axis makes an acute angle with its side.

Adam, Robert—was born at Edinburgh in 1728, and received his education at the University of that city. He was early distinguished for his taste in landscape drawing and composition, and at one period had devoted himself to that study, with a view of making it his future profession. He travelled to Italy in 1756, and was remarked for his assiduity in studying after nature, and making measurements of ancient Roman buildings. When he had visited almost every part of Italy, and drawn, for some years, its most remarkable antiquities, he felt, as all do, his knowledge of architecture as still imperfect. He found it necessary to add the observation of a *private edifice* of the ancients to his study of their public works. This led him to the scheme of visiting the Emperor Diocletian's palace of Spalatro in Dalmatia, that favourite building in which, after resigning the empire, he chose to reside. He knew, from the accounts of former travellers, that the remains of this palace, though tolerably entire, had never been observed with any accuracy, or drawn with any taste. He was likewise no stranger to the passion of that Prince for architecture, which prompted him to erect many grand and expensive structures at Rome, Nicomedia, Milan, Palmyra, and other places in his dominions. Adams had studied his public baths at Rome, one of the noblest, as well as the most entire, of all the ancient buildings, with no less admiration than care, which convinced him, notwithstanding the visible decline of architecture, as well as of the other arts, before the reign of Dioclesian, that his munificence had revived a taste in architecture superior to that of his own times, and had formed artists capable of imitating, with no inconsiderable success, the style and manner of a purer age: the names and history of those great masters are now unknown, but their works which remain, merit the highest applause, and the extent and fertility of their genius seem to have equalled the magnificence of the monarch by whom they were employed.

Induced by these circumstances, he undertook his voyage to Dalmatia, with the most sanguine hopes, and flattered himself that it would be attended, not only with instruction to himself, but might produce entertainment to the public.

Having prevailed on Mr. Clerisseau, a French artist, from whose taste and knowledge of antiquities he was certain of receiving great assistance in the execution of his scheme, to accompany him in this expedition; and having engaged two draughtsmen, of whose skill and accuracy he had long experience, they set sail from Venice, in July, 1757, and in eleven days afterwards reached Spalatro.

This city, though of no great extent, is so happily situated, that it appears, when viewed from the sea, not only picturesque, but magnificent. As they entered a grand bay, and sailed slowly towards the harbour, the marine wall, and long arcades of the palace, one of the ancient temples, and other parts of that building which was the object of his voyage, presented themselves to their view, and flattered him, from this first prospect, that his labour in visiting it would be amply rewarded.

"To these soothing expectations of the pleasures of my task," says Adams, "the certain knowledge of its difficulty soon succeeded. The inhabitants of Spalatro have destroyed some parts of the palace, in order to procure materials for building, and to this their town owes its name, which is evidently a corruption of Palatium. In other places, houses are built upon the old foundations, and modern works are so intermingled with the ancient, as to be scarcely distinguishable. Assiduity, however, and repeated observation, enabled me to surmount these difficulties. Attention to such parts of the palace as were entire, conducted me with certainty to the knowledge of those which were more ruinous, and I was proceeding in my work with all the success I could have expected, when I was interrupted by an unforeseen accident.

"The Venetian governor of Spalatro, unaccustomed to such visits of curiosity from strangers, began to conceive unfavourable sentiments of my intentions, and to suspect that, under pretence of taking views and plans of the palace. I was really employed in surveying the state of the fortifications. An order from the senate to allow me to carry on my operations, the promise of which I had procured at Venice, had not yet arrived, and the governor sent an officer, commanding me to desist. By good fortune, General Græme (also a native of Scotland) commander-in-chief of the Venetian forces, happened at that time to be at Spalatro, on the service of the state: he interposed in my behalf, with the humanity and zeal natural to a polite man, and to a lover of the arts; and being warmly seconded by Count Antonio Marcovich, a native of that country, who had applied himself with great success to the study of antiquities, they prevailed on the governor to withdraw his prohibition, though, by way of precaution, he appointed an officer constantly to attend me. The fear of a second interruption increased my industry, and by unwearied application, we completed, with an accuracy that afforded them great satisfaction, those parts of our work which it was necessary to execute on the spot."

The result of this voyage was his determination to present the details of the palace of Dioclesian to the public; and before his departure from Rome, he had already carried his project partly into execution, by having several of the drawings he had made at Spalatro engraven by some Roman artists.

On Mr. Adam's return to England, he was introduced to the court by the Earl of Bute, and, through the influence of that nobleman, he received the appointment of architect to their Majesties.

In 1764 appeared his work on the ruins of Spalatro, which he dedicated to the King. The engravings of views, plans, sections, and details, leave nothing to be wished for as architectural studies: and the style of the drawings, which was beautiful, being ably translated by the engravers, left every publication which had appeared in England at a great distance behind it. This splendid book placed him at the head of his profession; an eminence which it was his felicity to preserve to the end of a long and active life.

Being elected to represent the county of Kinross in Parliament, he resigned his office of architect to the King, but his practice and his fame continued to increase.

His life henceforward offers no incident of importance. His time was fully occupied in the practice of his profession; and no student ever laboured with greater ardour to acquire the mastery of his art than Mr. Adam did, from an enthusiastic love of it, after he had achieved both fame and fortune. The year before he died, he designed eight public, and twenty-four private buildings. There are few instances of houses of any magnitude being erected in England, in his time, in which he was not either applied to for his opinion or for his designs. In Scotland he was without a rival in his practice.

The architecture of Greece, in his earlier and middle time, was little known, and its beauties were not appreciated. The course of his studies having been turned into the channel of Italian antiquities, the general style of his works was founded on an imitation of Roman architecture, in its most florid period. Yet, in many of his works, where the taste for exuberance of ornament, which he had imbibed, was checked, either by the means of his clients, or the nature of the building, he produced compositions of great simplicity and elegance—and at almost all times he was happy in his outlines, and particularly in what are technically called his "sky-lines." The façade of the Register Office at Edinburgh is generally esteemed to be his finest public work; and, considering the date of its erection, and the general current of taste at that period, it is entitled to all praise, and his fame as a classical architect may be fairly and safely rested upon its merits. The Infirmary at Glasgow has also been admired for its elegance, but probably its claims have been greatly overrated — the whole composition wants *breadth*. The façade of Edinburgh University is not the most happy of his designs, either for outline, or imitation of the antique, yet some parts of its interior are equal to any thing he ever did.

Among his mansions, Luton is the finest. Here, the patron and the architect seem to have been guided by one feeling; and here Adam's fine taste in ornament could be indulged without any violation of propriety. It may rank, even now, as one of the most finished and classical residences of its size in England.

He was sometimes called upon to give designs for castellated and abbatial mansions, but they were sad failures. His name must be added to the list of those architects whose fine Roman taste had nothing in common with an imitation of the barbarian structures of the middle ages.

Whether we estimate Adam by the number and importance of his works, or the influence which their style had upon the practice and taste of his contemporaries, he was, without question, the most eminent British architect of his time. It is to him we owe the introduction of that light and fanciful style of *interior decoration* which superseded the tasteless and clumsy manner of his predecessors, imitated from the buildings erected by the architects of Louis XIV. and XV. His merit here was the greater, as at this period there were few or no antique examples of *ancient domestic Roman ornament*, to which an architect could appeal as his authority, or follow as a guide. His style, therefore, ought not, in fairness, to be subjected to a scrutiny or comparison with that founded on an imitation of Greek buildings, of which little or nothing was then known, but with that of his contemporaries and his models. It will then be found abounding in beauties of a high and original kind, and which, it is hoped, will long preserve them as examples of a style of arrangement and decoration to which we would give our unqualified admiration, had they been the production of an architect of the lower Roman empire.

Adam, James—was brother to Robert Adam, and his colleague. Whatever merits he possessed as a designer, they are merged in the more brilliant reputation of his brother. He was better calculated for a builder than an architect, and his practice of becoming a *contractor* for carrying his own designs into execution was an example (among one or two others) which has not only lowered the respectability of the profession, but has been the means of debasing the art itself.

Adhesion. A species of attraction exerted between the *surfaces* of bodies, and which has the effect of connecting them together. It is often confounded with *cohesion*, or the effect of a force retaining the component parts of the same body together. The mode in which delicate steel ornaments are sometimes fixed on a polished surface by a smart blow, or a great pressure, is an instance of adhesion. Water adheres to the fingers, and two pieces of lead or brass to each other.

The resistance which is sometimes experienced by bringing two highly polished and perfectly flat surfaces together, is familiar to every mechanic. Two leaden balls, not weighing above a pound each, nor touching on more (according to calculation) than $\frac{1}{50}$th of a square inch of surface, have lifted upwards of 130 pounds avoirdupois, the balls being first very finely planed by the edge of a sharp penknife, and then equally pressed together with a considerable force and gentle turn of the hand. The force of adhesion between two brass plates of about 4½ inches diameter, and slightly smeared with fat or grease, is so great, as to resist the force of two strong men to separate them. Two cylinders of glass, about two inches in diameter, heated to the degree of boiling water, and joined together by means of melted tallow lightly put between them, adhered with a force equal to 130 pounds. The adhesion of solids to fluids has been better investigated by experiments, but the details are foreign to the purpose of this work. Surfaces of different metals, for instance, adhere to the same fluid with very different degrees of intensity. Gold adheres to a surface of mercury with a force of 446, while copper adheres to it with a force of only 142.

A remarkable distinction between the effects usually attributed to friction and adhesion may be seen from the following experiment:—Two bodies, which adhere together with a force of 132 pounds, when the separating force acts at right angles to the adhering surfaces, may be separated with a force equal to a few ounces, when the forces act in the same line with the surfaces, or so as to make them *slide* over each other. Friction and adhesion are both diminished by a motion, however small, communicated to the fibres or particles of the adhering surfaces. Two brass cylinders, requiring 60 or 70 pounds to separate them, will fall asunder with their own weight, if the edge of a knife is drawn slowly along one of their edges; in the same manner that a balance will vibrate when it is poised, by communicating a slight tremor to the fulcrum or beam, by drawing a sharp edge over it. A bolt or a nail may often be started by a slight blow let fall near it, when no mechanical means could overcome its adhesion by a mere pressure.

This adhesion of bolts and nails is further influenced by *cohesion* and by *friction*. From some woods a nail may be drawn with a less force than others,—an effect well known to the Romans, who objected to the use of cedar in ship-building, from its not holding well together, and being apt to become what is now called iron-sick. This force does not at all appear to depend on the hardness or gravity of the wood. A nail may be drawn from oak easier than from the abele-tree: the stiffness and strength of the two are very different, and also their gravity; and the cohesion of oak is also the greater. From this effect, which may often be observed in other instances, it would appear that the phenomena can be better understood, by comparing the action to a sort of *muscular contraction* of the fibres of the wood, and which is greater when the adhesion takes place across the fibres, than in the same direction with them.

The fact of particular woods holding nails and bolts much better than others, is familiar to every workman, but the reason of this has never been investigated. The only experiments on the subject, at all of a practical nature, or adapted to common purposes, are those by Mr. Bevan, in Gill's Technical Repository for March, 1824. We copy them here, as wishing to draw the attention of other experimenters to a subject apparently humble, but of immense importance in every kind of construction.

"The insertion of a nail is accomplished by destroying the cohesion of the wood; its extraction, by overcoming the force of adhesion and friction. We will consider it here solely as a case of adhesion; fine sprigs, 4560 of which weighed one pound, $\frac{44}{100}$ of an inch long, forced into four lengths of an inch into dry Christiana deals, at right angles to the fibres, required a force of 22 pounds to extract them.

"The same description of nail having 3200 in the pound, $\frac{44}{100}$ of an inch long, and forced $\frac{44}{100}$ of an inch into the same kind of wood, required 37 lbs. to extract it.

"Threepenny brads, 618 to the lb. weight, one and a quarter inch long, forced half an inch into the wood, required 58 lbs. weight to extract them.

"Cast-iron nails, 380 to the lb. weight, one inch long, driven half an inch into the wood, required a force of 72 lbs. to draw them out.

"Fivepenny nails, 139 to the lb. weight, required two inches long, forced one inch and a half into the wood, required a force of 320 lbs. to extract it.

"Sixpenny nails, 73 to the lb., two inches and a half long, driven an inch into the wood, required 170 lbs. to extract it.

"The same kind of nail forced one inch and a half into the wood, required 327 lbs. to draw it out; and when driven two inches, required 530 lbs. to extract it. In this last experiment the nail was forced into the wood by a nail of cast-iron, weighing 627 lbs. falling from a height of twelve inches, four blows of which were necessary to force the nail an inch and a half into the wood. It required a pressure of 400 lbs. to force the nail to the same depth.

"A sixpenny nail driven one inch into dry elm, across the grain of fibres, required 327 lbs. to draw it out by direct force; driven end-ways into dry elm, or parallel with the grain, it only required 257 lbs. to extract it.

"The same sort of nail driven into dry Christiana deal, was extracted by a force equal to 257 lbs., and by one of 87 lbs. from a depth of an inch.

"The adhesion of a nail, therefore, driven into elm *across the grain*, or at right angles to the fibres of the wood, is greater than when it is driven with the grain, or parallel with the fibres, in the proportion of 100 to 78, or 4 to 3.

"And under the same circumstances in dry Christiana deal, as 100 to 46, or nearly 2 to 1.

The *comparative* adhesion of nails in elm and deal, is between 2 and 3 to 1.

"To extract a sixpenny nail driven one inch into green sycamore, required 312 lbs.; from dry oak, 507 lbs.; and from dry beech, 667 lbs.

"A common screw of one-fifth of an inch had an adhesion about three times as great as that of a sixpenny nail.

"A common sixpenny nail driven two inches into dry oak, would require more than half a ton to extract it by pressure."

In making these experiments, Mr. Bevan observes that great care was taken to apply (to add) the weights steadily, and that towards the conclusion of the experiment, weights not exceeding 10 lbs., were laid on, with a moderate interval between each addition.

There are few more inexplicable phenomena in mechanical philosophy than those influencing adhesion and cohesion. The adhesion has been thought by some philosophers of great experience to arise from the pressure of the air, an hypothesis shewn to be liable to considerable exceptions by some experiments made by Haukesbee and others.

That there exists a tendency to adhesion between all objects in nature, absolutely independent of atmospheric, and all other pressure, is warranted by experience; although this pressure is in many cases essential both to the commencement of the adhesion, and has considerable influence afterwards in determining its intensity. Haukesbee found that the intensity of adhesion had some relation or proportion to the number of touching points; and that this depended, in solid bodies, on the degree in which their surfaces were polished and compressed; or the effects of interposing glue or cement between solids, to promote their adhesion. See *Cement*.

Adit. The approach, or entrance to a building—a door-passage, or communication.

Adits. Doors on the stairs in ancient theatres, whereby people entered from the porticoes, and descended to their seats.

Adit of a mine. The drift, or the excavation by which the mine is entered, and the water and ores are conveyed to the surface. They are commonly made on the side of the hill towards its base, and are from four to six or seven feet high; sometimes cut in the rock, or supported with timber: the bottom of the adit nearly answers to that of the shaft, only a little lower, to allow the current of water to pass away without the use of a pump. Damps and impure air are the great impediments against driving adits beyond twenty or thirty fathoms, from the necessity of sinking shafts to meet the adit both for air and light.

Adit is sometimes used also for the *air-shaft*.

Admeasurement. Adjustment of proportions; technically, an estimate of the quantity of materials and labour of any kind used in a building.

Adrian. Publius Ælius, a Roman emperor, was born at Rome, seventy-six years after the birth of Christ. His ancestors lived at Italica in Spain; at an early age he received the name of the "Young Grecian," from his great proficiency in that language. He distinguished himself as a general under Trajan, and, at the death of that prince, he was proclaimed his successor, by the Roman legions in Syria; and, by his policy and prudence, he succeeded in gaining the confidence and affection of the Roman people. He visited almost every part of his empire; and his journey to the Roman province in Britain was distinguished by the erection of a wall, extending from the Solway Firth on the west to Newcastle-upon-Tyne on the east, to secure the southern part which belonged to the Romans from the incursions and inroads of the Caledonians. See *Adrian's Wall.*

On his return to Gaul, he built a magnificent palace for Plotina, the widow of Trajan. In Spain, he rebuilt the Temple of Augustus at Tarragona. At his visit to Athens, he adorned it with so many splendid edifices, that in gratitude the Athenians revered him as the second founder of their city, and called a part of it by his name. He rebuilt the cities of Nicæa, Cæsarea, and Nicomedia, which had been destroyed by earthquakes, and repaired, among others, the tomb of Pompey the Great and Epaminondas, and also the city of Alexandria, and built Antinoe. In the year 135, he returned to Rome, and falling into a lingering disease, he retired to Tibur, and there he erected a magnificent villa. See *Adrian's Villa.* His disorder increasing, he was removed to Baiæ, in Campania, where he died in the year A.D. 138, after having reigned nearly twenty-two years. His ashes were brought to Rome, and deposited in a superb mausoleum, which he had constructed in his life-time on the bank of the Tiber. See *Adrian's Mausoleum.*

No prince ever erected so many public and private edifices as Adrian. In his plans of public improvement, he was comprehensive and liberal, even to the extreme of needless magnificence and profusion. There was hardly a province or a city on which he did not confer some substantial mark of his regard, for the convenience and comfort of its inhabitants; in repairing old edifices, building new ones, baths, aqueducts, harbours, and forums; and he expended large sums in renovating and embellishing the monuments which had been raised in former times to statesmen and heroes.

Adrian was a poet and a philosopher, as well as an architect. "In him centred the most opposite qualities, the most splendid virtues, and the most degrading vices. Profuse and liberal — frugal even to avarice—merciful in many points—but, in others, a monster of cruelty, we shall not be far wrong," says Crevier, "if we consider his vices as real or constitutional, and his virtues as fictitious, prompted by an unmeasurable vanity and deep policy. His government, on the whole, was for the good of the people in general, as this was essential to his safety; but his personal conduct made him the terror and scourge of all who were near him."

Adrianeum. The tomb erected by Adrian at Rome. (See *Mausoleum.*)

Adrianople, the second city in the Turkish empire. "We entered the city," says Dr. Macmichael, "by a long, narrow bridge, built over the Tundsha, which falls into the Mariza at a little distance below the town to the south. Passing along narrow streets, darkened by wooden projections from the opposite houses, we stooped under a very low ruined brick archway, in the wall of the fortress, and alighted at a place crowded with Albanian troops of the Pasha." The meanness of the private buildings are, however, a contrast to the magnificence of some of the public edifices. The mosque of Selim is said to be one of the largest and most beautiful Mohammedan temples in the world. Its four minarets are fluted, and are of a very elegant construction. Mrs. Macmichael was permitted to see the interior. The floor was covered with carpets, and many lamps and ostrich eggs were suspended from the ceiling of the immense dome. On one side stood an elevated chair or pulpit, to which a very narrow and steep flight of steps conducted. In the centre of the mosque was a spring, surrounded with a circular screen. The exterior court of the mosque is paved with large slabs of white marble, and the antique columns of the cloisters round it, are of various orders and dimensions, but all of the most costly materials, either *verde antique*, Egyptian granite, or Cipollino marble. The next chief building is the famous mosque of Ali Pacha. It is a brick building, vaulted with arches, consisting of alternate red and white bricks. A gate at each extremity, and four lateral ones, form so many entrances, and its length is about 300 paces. Sepulchral monuments of white marble, many of which were covered with ornamental canopies of the same material, and all having a most splendid appearance, line the road on each side for a continual distance from the city.

Adrian's Wall. *In ancient Military Architecture.* A wall, or mound, erected by the Emperor Adrian, across England, beginning about three miles eastward of Newcastle, and ending ten miles to the west of Carlisle, measuring in length about seventy miles.

This wall has passed by different names at different times, and in different languages. It was called, by ancient writers, *Vallum Barbaricum*, *Prætentura*, *Clusura Vallum*, or *Murus;* by the Greeks, *Xomo*, and *Diateixisma;* by the English, the *Picts Wall*, or *The Wall;* and by the Britons, *Gual Sever*, *Gal Sever*, and *Mur Sever*. The names *Prétentura* and *Clusura* being given to it on account of its stretching out against, and excluding the enemy.

The material of which it was composed, was earth taken from the ditches, sometimes mixed with stone; but there is no appearance of any timber ever having been used in its construction.

It was carried from town to town, as much in a straight line as a work of this nature and extent could be.

Adrian's wall is sometimes confounded with that of Severus, which was built on nearly the same line, and which appears to have been intended for a more permanent defence than that built by his predecessor.

The defence consists of the principal *agger*, or *vallum*, on the brink of the ditch—the *ditch*, on the north side of the vallum; another *agger* on the south side of the vallum, and about five paces distant from it, which may be distinguished from the other by the *south agger*, and a large agger upon the north side of the ditch, called the *north agger*. This is supposed to be the military way to the ancient line of stations. The *south agger* was an inner defence, in case the enemy might beat them from any part of the principal vallum or to protect the Roman soldiers against any attack from the provincial Britons. It is generally somewhat smaller than the principal vallum, but in some places it is larger. These four works keep all the way a constant regular parallelism to each other.

In one part of this line of Adrian's wall, which is still remaining, the ditch measured nine feet in depth, and eleven feet over, the top being wider than the bottom, from the sides sloping. The north agger was about twenty-four feet north from the ditch, and of the two aggers of the vallum, one is always detached about thirty feet to the south of the ditch, and the other upon, or near the very southern edge of it.

It is the opinion of some antiquaries, that Severus's wall was built upon the same foundation with Adrian's, and with regard to some parts of its line, this is a probable conjecture; for if the north agger has been an old military way, the supposition of a rampart, and a ditch to the north of this way, would remove the difficulty as to the soldiers being exposed to the enemy, whilst they were on their march, since then the way would have been defended on both sides. Again, the stations too, as well as the military way, are generally (though not always) included between the two walls and ditches (or between the works as they are distinguished, erected by Adrian and Severus.) The stone wall erected by Severus frequently falling in with the north rampart of the station, as the turf, or earthen wall of Adrian does with the southern; besides, this advantageous ground is often left on the north side of Adrian's vallum, which in one place is just carried round the south skirt of a tumulus, or small hill, making a sudden turn, seemingly with a design to avoid passing over it. Now it is contended that if this were intended to be the most northerly fortification, and to be a fence against the northern enemies, this conduct seems to offend against right reason, and the rule in ancient military building, that care should be taken to have no neighbouring hill higher than the fortification, which being seized by the enemy, might be turned to the annoyance of those within the line of fortification. The southern prospect of Adrian's work, and the defence on that side, is generally better than on the north; whereas the northern prospect or defence has been principally, or only, taken care of in the wall of Severus. Such considerations have induced some to think that what now goes by the name of Adrian's Wall, was originally designed for a fence against any sudden insurrection of the provincial Britons, and particularly of the Brigantes; whilst others look upon it as a *fossa interior*, or inner fortification, for the soldiers to retire to, after they had been beaten off by the northern enemy from their principal vallum: both agree in this, that Adrian must have built a more northerly vallum than those which now bear his name, and that this must have stood upon the same tract where Severus afterwards erected his wall. This, according to their opinion, would render the whole fortification regular and effective; whereas, without this, it must have been in many places very weak, and open to the inroads of the Caledonians.

But, on the other hand, plausible conjectures and speculative arguments, must give way to stronger proofs, though not quite decisive, on the other side; for at this distance of time we cannot see into the design of the Romans, nor account for every particular part of their system in these erections. It is probable that Adrian's north agger was the most ancient military way leading from station to station, and that the subsequent erection was guided and limited by it, as it keeps a constant parallelism to it; the north agger, considered as such a military way, appears to be conducted according to the Roman art and rules, in every part of it. It is carried on in the shortest line from station to station; and this, without doubt, is the true reason why it runs so much upon the southern skirts of the northern hills—the shortest line leading that way; a circumstance particularly remarkable in the small hill now called Halton Chesters: the direct line would have led over the hill, but to avoid climbing it, a small turn is made to carry it round the skirt, and it passes on the south side rather than on the north, because this is the shorter and more convenient way to the station towards which it is tending. The other parts of Adrian's work keep their due distance and parallelism, bending exactly in the same manner as the north agger does, and so running at a few yards' distance to the south of the hill. In a word, the north agger, or old military way, keeps just such a course, and runs through such grounds as one would expect such a Roman way should do. And had it been determined that Adrian's work should accompany this, and keep all along an exact parallelism to it, they must then be tied down, and the work at some places would show some irregularities and deviations from the usual manner. It may be said that they might at least have made the fortification on the north side of the military way, if there was no other more northerly defence; but it will appear that it was hardly practicable to carry on the work on the north side of the way so as to be near and parallel to it; and such is the situation of the ground, that if the Roman architects had done so, the defence would have been generally weaker than it is, running along the very side of the hills, unless they had made it where Severus's wall stands, and where it has been said Adrian's principal vallum stood; but, in fact, Adrian made no vallum there.

Among all the historians who mention the building of Severus's wall, there is not the least hint to be met with, of his building it upon the same foundation with Adrian's vallum. Spartian's expression, "apud vallum," looks the likest of it of any, but this may be considered to be "near" to the vallum, with as much reason as upon it; besides, it would be more laborious and expensive to build such a wall upon a ruinous vallum, than to erect it upon ground that was entirely clear, even supposing that the ideas of stability among Roman architects would have permitted their erecting a stone wall upon the foundation of an artificial earthen one. There is likewise no appearance at present of any such vallum, and it seems difficult to suppose that the agger of earth has been every where so entirely removed, as to leave no visible remains of it any where along the whole tract of the wall. Again, Severus's wall passes over large spaces where the erecting of an earthen rampart seems almost impracticable; sometimes it passes for a considerable way along the tops of precipices, and sometimes down the steep declivity of a bare rock, and in these places there is no ditch; in one place it is carried through a small morass, where its foundation may be helped with piles of wood; but Adrian's work shuns it, and runs at ten chains' distance from it.

The constant parallelism of the north aggar—the ditch and the two southern aggars of Adrian's wall, is a sure indication of their mutual relation; but this parallelism does not hold in the wall of Severus: where they are most distant, there are no visible branches of any military way leading from the one to the other, whereby the communication between them might be more easily preserved: in some places, as we have seen, there is a morass between the two walls, which must make a retreat from one wall to the other inconvenient, if not impracticable. The military way that now follows Severus's wall is agreed to have been made at the same time with the wall itself; if, then, Adrian's principal vallum was on the same ground where the wall of Severus has stood, how comes it to pass that there has been no military way accompanying it.

If Adrian's work is supposed to have been designed for a defence against an attack from the south, difficulties almost insurmountable are raised, for sometimes the advantageous ground is left on the south, where it might easily have been otherwise ordered, if their design had only been to secure themselves against assailants from the south, and the course of their fortifications had not been previously determined by some other rule. In one place, the vallum runs between higher grounds on each side; besides, if it were designed against an enemy from the south, the ditch is on the wrong side, being to the north of the two ramparts: and why may it not be supposed that the most southerly rampart either was a slight fence against an attack from the south, or an interior defence to retreat to, if the ditch should be carried by an assault from the north? There was no occasion to draw such a line of defence, in order to prevent an attack being made upon the stations, for they are stronger on all sides than this vallum. As far as the old military way is concerned in the difficulty, it would be better lessened by observing, that there is an inner military way, which is also shorter, that reaches half the length of the wall from Walwick Chesters to Carrvoran in Northumberland, and probably as far as Stanwicks in Cumberland. Each end of Severus's wall is continued beyond Adrian's: this could not be erected on Adrian's vallum, and there is no difference in the appearance of the work here and in the other parts of it.

In one part of the line of defence, between Carraw and Threeppell House, the united military way was eight yards broad and about four feet high; in some places it is much higher; farther to the west, nine feet broad or more. The north agger continues after the separation large and high, though neither so large nor so broad as when the two were united. Its remains were mixed with stones, and no regular pavement now appears. Severus's military way, after his parting, appears little raised, but regularly paved: near this separation Adrian's vallum keeps the *low* ground all the way, and for a good space is in a narrow ground between two hills; while Severus's runs along the very brink of the precipices, which in some places have been made steeper by art, in order to render them more inaccessible. They have made no ditch to Severus's wall, when they had the advantage of a precipice, nor was there the least occasion for it, but in the hollow intervals between the rocks, they have often drawn a ditch.

Adrian's wall, as well as that of Severus's, would have been incomplete without a chain of forts built at certain distances, so as to preserve the communication throughout its line, both for succour in case of attack, and also to form a sort of military observatories, in which they could overlook the operations or motions of their antagonists. It is probable that this series of forts called stations, *per lineam valli*, placed quite across the country, existed before the construction of this wall; a mode which was used by Julius Agricola. "It is probable," says Camden, "that in times of peace the frontier garrisons were kept along the line in castles and cities; but when they were apprehensive of the incursions of their neighbours, part of them, for the defence of their own, pitched their tents in the enemy's country, and made excursions into their quarters, and hence we hear of *stationes agrariæ*." "Agricola," says Tacitus, "built such a row of forts quite across the country in Scotland, and Antoninus built his wall along the same tract. So Adrian carried his wall from fort to fort, which had been erected before his time; and we find the course of the wall directed as much as it well could be from station to station, and making some turns with no other view but to come up to, and fetch in a station. Severus's wall generally falling in with the north rampart, and Adrian's with the south, though sometimes both the one and the other fell in with the middle station. In some particular cases they both keep on the *north* side, and touch not the station at all. It is remarkable there is not one of those stations, which is all of it on the north of Severus's wall, though it is sometimes different with Adrian's, and the reason for this peculiar arrangement might be, that the stations were stronger than Adrian's vallum, and so generally left without it. But Severus's wall was made as strong, or stronger than they, and, therefore, was erected more to the north, and included them all within it. For an account of these stations, see *Castellum*, *Castramentation.*

The objection to the north agger being a military way, on account of its laying to the north, or enemies' side, with respect to Adrian's vallum and ditch, may be accounted for, if we consider it to have been in existence before that emperor began his operations, and to have run between station and station: it is, however, within, or on the south side of, this line of stations. Perhaps Adrian's vallum and ditch, at the same time that it joined and strengthened the stations, might also have been designed for a place of retreat for the soldiers, if they should at any time be suddenly attacked on their march. If the vallum of Adrian had been carried on all the way on the north side of what is here considered to have been the old military way, it would, in the main, have been weaker as a defence than it now is; for, as the north agger runs very often along the south skirt of the hills, so, if the ramparts and ditch had been north of it, they must have gone along the very side, or declivity of the hill, leaving the upper part of it on the north: they might, therefore, choose to make the vallum stronger, though this military way should be more exposed to the enemy: the vallum was to be a constant fence to the whole province, the military way was only used on occasions, and therefore it was advisable to give the preference to the vallum for strength and security, especially, as has been noticed, that this very vallum might also be a security to the soldiers when marching; for, upon the first appearance or intelligence of the enemy, they might retire quickly behind it. There do not, however, appear to be any convenient passages for this retreat, except at the stations,—a difficulty which is quite as great to get over, on the conjecture that the north agger was a rampart to receive the first assault of the northern enemy; for, if the Romans were beaten off this, they must, of course, be precipitated into the ditch, as they had not means, at least none now appear, for passing it. The north agger generally runs along such ground as is fittest for a military way, and such as the Romans usually made choice of; for it enters, or keeps the ground that is a little higher than the adjacent, or else the skirt of a hill without climbing it; by this means the way was preserved dry, and the rain ran off as it fell.

Adrian's Villa. Though far inferior to his predecessor in virtues and great qualities, the Emperor Adrian left, in almost every corner of the empire, splendid proofs of his knowledge, taste, and love of architecture. His villa, three miles from Tivoli, was one of the most extraordinary buildings ever erected.

Adrian seems to have intended to collect, in this spot, all the various excellences of the buildings of the numerous countries he had visited:—Egyptian erudition, Asiatic magnificence, and Grecian elegance, were here united to recal to his recollection those scenes which had, in his travels, attracted his admiration or wonder. The buildings and plantations appear to have extended over an area about six miles in circumference (Winkelman says ten); there were probably other edifices and gardens in the vicinity, which also belonged to him, if we may judge by inscriptions found amongst ruins situated at a greater distance.

This gorgeous villa was divided into seven parts: the *Lyceum*, the *Academy*, *Prytaneum*, *Egyptian Canopus*, *Pœcile*, *Valley of Tempe*, or Elysian Fields—and *the Infernal Regions*.

The principal gate appears to have been placed towards the Ponte Lucano, whence there was a paved road to the villa. On entering the gate, there were numerous buildings, where, it is conjectured, the military guards attending upon the Emperor were lodged.

The Pœcile was an imitation

of the portico at Athens, so named on account of the numerous paintings with which it was adorned. A wall, running east and west, divided this portico, which protected those using it from the heat of the sun at all hours of the day. Adrian was accustomed to assemble learned men in this portico, and several apartments adjoining to it were dedicated to the prosecution of their studies—a temple stood near it. Near this spot was an oval space, surrounded with a portico, and having in the midst an octagon temple with a fountain. The frieze of this building was adorned with elegant bas reliefs of cupids drawn by wolves and swans. At a small distance stood a library, raised on a high wall, with twenty-five niches for statues; and on an adjoining eminence a theatre with porticoes, and numerous dressing-rooms for the actors.

In the southern division were the hot and cold baths, with the different apartments usually attached to them, dressing-rooms, galleries for wrestling and walking, decorated with sumptuous ornaments of marble, stucco, and painting.

Adjoining the academy was a circular temple, dedicated to Apollo and the Muses, with habitations for the priests and ministers, with numberless schools and houses for the accommodation of the students, with gardens, groves, and great abundance of water, brought from a considerable distance. Beside the temple was a menagerie.

In the Lyceum were contained numerous restorations of Grecian buildings—here were placed Xystus, and porticoes for the Peripatetics—temples and groves almost without number.

The part called Canopus, had a temple dedicated to Egyptian Canopus. This represented an immense shell, and at the back of it was a gallery, and the abode of the oracle. This temple stood at the end of a valley, which contained a naumachia, where the Emperor used to celebrate games in honour of Canopus. The winding stairs, which the different spectators ascended and descended without incommoding each other, have been greatly celebrated.

At the other end of the valley was a place called the Infernal Regions, where streams were introduced, named Lethe, Cocytus, and Phlegethon, with numerous buildings and paintings, alluding to similar subjects; and also here were habitations for slaves.

Not far from this spot was a division of the villa, called the Valley of Tempe, with the Elysian Fields, where every thing the most beautiful was collected, and where nature vied with art in the profusion of her beauties. This part of the villa was eminently delightful and attractive.

The *Prytaneum* was at the southern extremity, and was built in imitation of that at Athens, which was a court of justice, with dwelling-houses for the judges and officers belonging to them.

When Adrian had completed this wonderful assemblage of riches and magnificence, he celebrated the Eucænia, and performed a solemn sacrifice to Hercules.

These are thought to have been the grand divisions of this celebrated villa, which, in less than forty years after it had been completed, began to be dilapidated. His successor removed some of the most valuable ornaments, to decorate the baths he erected at Rome. Caracalla also removed many of the ornaments. Succeeding emperors following his example, the villa was stripped of its decorations, and abandoned.

Of this immense building there are still some considerable parts in existence, and the foundations of the greater part can still be traced on the spot—at one extremity are seen two *theatres*. In one of these buildings the exterior portico may be traced—the rooms for the actors, and the stairs by which they ascended to the theatre; the stage-door, the side porticoes of the proscenium, and the orchestra. The *palæstrum* forms a great court, around which, from the appearance of the ruins, were porticoes and arcades. At the further end is a large recess, in which, it is thought, the emperor was placed when he reviewed his troops. A small edifice is still nearly entire, conceived to be the remains of a bath. All the apartments of which this building is composed are very small, and are lighted from the top. Their forms differ from each other, and many of them are exceedingly singular.

The circular court of the menagerie is also visible, and the basin of the naumachia, which is filled with the waters of the Anio. Winkelman says, that the basin has formerly been lined with "Jaune antique" marble. Another square court may be traced, having a small rotunda at its extremity, of which the circumference is formed by three concave arches and three convex arches placed alternately.

In another ruin are found many parts finely proportioned, and the forms academically varied. The ruins of the Temple of Canopus overlook the naumachia. In this spot were found the sea-horse sacred to Neptune, Isis, Osiris, Orus, the Ibis, and other hieroglyphics, characteristic of an Egyptian building. In Kircher's time the stairs, constructed so as to prevent those who either ascended or descended from meeting each other, could be traced At the bottom are the ruins of a grand niche, ornamented with a number of smaller square niches in its circumference. By what has been found in this spot, it appears that it was a grotto adorned with cascades. The light is admitted into this grotto in a manner very favourable to the general effect.

In another quarter, near that which is supposed to have been the Elysian fields, are some halls almost perfect. Above all, one which is called the "Stanza d'Adriano;" also the ruins of grand staircases, courts, colonnades, temples, and aqueducts, and a hippodrome, or riding-school.

The ruins on the north side consist in a court or square, a circular portico, and a quadrilateral temple, with a semicircular tribune, containing seven square niches.

The most celebrated of all these ruins, according to Winkelman, is that portion named the "Hundred Chambers," appropriated for the emperor's guard: they had no communication with each other except by an external gallery of wood, of which the communication was interrupted by a single sentinel. There is the remains of a round building, which it is supposed was occupied by soldiers of the body-guard. At each rising of the arch were two pannels upon the faces of the projecting stones: on one of these was observed the initials, or abridged name, of a soldier, written in black, as if with the finger.

The *plan* of the ruins of this villa gives a clear idea of its great extent: the names marked on it are those which are usually given to the various parts by antiquaries. The dark shading distinguishes the portions comparatively in good preservation, and the lighter shading, or dotted lines, those divisions which are in a more ruinous state. Under the word *ceiling* will be found some of the remains of the interior decorations of this gorgeous palace.

The site of this villa has not ceased, since the revival of the arts, to be a mine, from which its proprietors have extracted immense numbers of the finest remains of ancient art; and it is rare that the labour of a new search, or excavation, is not rewarded by the discovery of some of its seemingly inexhaustible treasures. From this spot, the principal European museums and collectors are indebted for many of their most valuable antiques.

Aduar, Adouar, Adouard. A kind of ambulatory village among the Arabs, and moved for the convenience of pasturage and water. It has been estimated that there are upwards of thirty thousand of these aduars in the kingdom of Algiers alone.

Advanced-work. *In military architecture.* A work constructed beyond the covered way, or glacis of a fortress; but either near to the foot of the glacis, or at a moderate distance from it—not generally exceeding 250 yards, in order that such work laying under the protection of the fire of the fortress it may derive aid, in case of being attacked by an enemy.

The term is used as opposed to a *detached work*, or one at such a distance (between 800 or 900 yards) as not to receive effectual support from the fortress.

Advance-Fosse. *In military architecture.* A ditch thrown across the esplanade, or glacis of a place, to prevent its being surprised by the besiegers. The ditch sometimes made in that part of the lines or retrenchments nearest to the enemy, to prevent him from attacking them, is also called the advance-fosse. This defence should always be filled with water, otherwise it would serve as a shelter to cover the enemy, if he got possession of it, from the fire of the battery or fortress; redoubts and other works are usually constructed beyond the advance-fosse.

Advanced-Traverse. *In military architecture.* See *Traverse.*

Adze, or Addice. A cutting tool, of the axe kind, having its blade made thin, or arching, and set at right angles to the handle. It is chiefly used for taking thin chips off timber or boards, and for paring away those inequalities which the common axe, from its form, cannot touch.

The greater proportion of timber used in many ancient buildings appears to have been fashioned with this instrument. It is still employed by *carpenters*, but its use, from the perfection of other instruments, is on the decline; ship-carpenters very generally use it, and in their hands it is an instrument as pliable as it is effective. Coopers find it a convenient tool for many purposes.

It is ground from a base on its inside to its outer edge, and on this account the blade is required to be detached from the handle, previous to having its edge repaired. See *Tool.*

Adytum, (*aduton*, Gr.) A retired or sacred place in ancient temples, which no one but the priest was permitted to enter. It was usually dark, except when illuminated with flambeaus, and the statue of the Divinity was placed in it, to prevent its too near inspection by its worshippers. The adytum was sometimes a subterranean chamber. Pausanias, describing a temple of Neptune in the isthmus of Corinth, mentions "a place under ground, called an *aduton*, where it is reported Portunces lay hid. In which place, if any one, Corinthian or stranger, perjures himself, he will certainly die for his impiety."

At the foot of the hill of the Acropolis of Argos was found one of the most curious tell-tale remains yet discovered among the vestiges of Pagan priestcraft. One of the oracular shrines of Argos, alluded to by Pausanias, laid open to inspection, like a toy a child has broken, in order that he may see the contrivance whereby it was made to speak: a more interesting sight for modern curiosity can hardly be conceived to exist among the ruins of any Grecian city. In its original state it had been a temple. The farther part from the entrance, where the altar was, being an excavation from the rock, and the front and roof constructed with baked tiles. The altar yet remains, and part of the fictile superstructure; but the most remarkable part of the whole is a secret subterraneous passage terminating behind the altar, its entrance being at a considerable distance towards the right of a person facing the altar, and so cunningly contrived as to have an aperture easily concealed, and level with the surface of the rock. This was barely large enough to admit the entrance of a single person, who, having descended into the narrow passage, might creep along until he arrived immediately behind the centre of the altar, where, being hid by some colossal statue, or other screen, the sound of his voice would produce a most imposing effect among the humble votaries prostrate beneath, who were listening in silence upon the floor of the sanctuary. "We amused ourselves," says the traveller, who discovered it, "for a few minutes, by endeavouring to mimic the sort of solemn farce acted upon these occasions, and as we delivered a mock oracle, *ore rotundo* from the cavernous throne of the altar, a reverberation caused by the sides of the rock, afforded a tolerable specimen of the '*will of the gods*,' as it was formerly made known to the credulous votaries of this now-forgotten shrine. There were not fewer than twenty-five of these juggling places in Peloponnesus, and as many in the single province of Bœotia; and surely it will never become a question among learned men, whether the answers in them were given by the inspiration of evil spirits, or whether they proceeded from the imposture of priests. Neither can it again be urged that they ceased at the birth of Christ, because Pausanias bears testimony to their existence at Argos in the second century after Christ: perhaps it was to this very shrine that his evidence refers."

At Delphi there was a superstition that the adytum of five stones of the Temple of Apollo stood in the middle of the earth, and the navel of the world was shown in the shrine, as it was also in the Holy Sepulchre at Jerusalem.

Amongst all that now remains of the Antiquities of Greece, there is nothing better authenticated, than the Hieron of Trophonius, the site of it being distinctly ascertained by the cavities grooved in the rock, for the reception of the votive offerings. The only uncertainty respects the *adytum*, where the oracle was supposed to reside; for although the mouth of this place seems very accurately to correspond with the account of it given by Pausanias, the interior has never been explored in modern times. Every thing belonging to the Hieron appears to exist in its original state, except that the *vows* have been removed from the niches, wherein they were placed; and that the narrow entrance, supposed to lead to the *adytum*, is now choked with stones and rubbish. The women of Lebadea kindle fires here while washing their linen, and the sides of it are consequently covered with soot.

This aperture in the rock is close to the ground; immediately below it, in front of the little terrace, above which the niches were cut for the dona votiva, a fountain issues from several small pipes, often out of repair, into a bath, the interior of which is faced with large hewn stones and pieces of marble; here the Lebadean women wash their linen. This bath was used by those who came to consult the oracle; for these persons were obliged to purify themselves, and abstain from the use of hot baths—a few paces from this, is the spot where the river Hercynia bursts forth. It rises, according to Pausanias, within the *cavern*. It is from this clear, that the cavern and adytum were two distinct things:—the first was a small aperture within the other, and the appellation was applied to the whole of the chasm, or range of precipitous rocks, around the place which contained not only the sacred aperture but all the source of the Hercynia, and perhaps the grove of Trophonius, with all its temples, statues, and other votive offerings.—Pausanias describes the stoma, or mouth of the adytum, as it now appears, to have been a small opening like unto an oven, and it was near the terrace and floor; for the votary lying down was thrust into it, with his feet foremost, the rest of his body being rapidly hauled in afterwards by some person or persons within the adytum.

The most sacred part of the Hieron, containing the narrow entrance to the adytum, and the receptacles for the offerings, is a perpendicular rock of black marble. It faces the east. The niches are above the *stoma*, or entrance to the adytum, and are 12 in number—the most capacious is an entire chamber excavated from the stone, of 12 feet 8 inches long, 11 feet 3 inches wide, and 8 feet 9 inches high; this contains a stone bench 8 feet 9 inches long, 14 inches wide, and 16 inches high; immediately below the chamber, which is elevated 5 feet 10 inches above the ground is the *stoma* or *sacred* aperture of the *adytum*. It is small and low and shaped like an oven, and it is in fact barely capacious enough to admit the passage of man's body; the adytum itself could not be explored from the passage being choked with rubbish, which the traveller who discovered it had no means of removing. The small *area* in front of the sacred aperture was surrounded by a wall of white stone not more than two cubits high, this being all the elevation necessary to conceal it from sight.

In the Parthenon, a peplus, or curtain, was upon ordinary occasions interposed between the statue of the goddess and the worshippers; "this served to defend the statue from dust and moisture, which entered through the hypæthrum; at the same time that it added to the sanctity of the goddess by preventing her from being seen upon every occasional opening of the door. The enclosed space may be considered as the adytum, and the hypæthral part of the chamber the sanctum. This curtain was embroidered with the battles of the gods and giants, the warlike actions of Minerva, chariot-races, and portraits of illustrious Athenians. In the temple at Ephesus an ascending curtain was used, but it is probable that in the Parthenon of the Acropolis, as well as in the temple at Olympia, the curtain was a descending one."

On making an excavation in the ancient city of Pompeii, a temple of Isis was discovered. The outward appearance of this building was simplicity itself, its architecture slight, and without any pretensions to the grandeur or solidity of those places of worship which were dedicated to the great national deities. The votaries of the Sabine Isis, as she is named in an inscription still fixed in the wall, were ambitious only of erecting a small, neat sanctuary, not a grand fabric, as perhaps the earthquake, which did incredible damage in Campania in the reign of Nero, had affected their fortunes too sensibly to allow of a more extensive undertaking. The walls are covered with ornaments in stucco executed in a coarse manner: the *penetrale*, or *adytum* of the temple, is a small pavilion raised upon steps, under which is a vault, that may have served for the purposes of oracular imposition. The statue of the goddess had disappeared before the area was uncovered.

The *secos* of Egyptian temples, described by Strabo, appears to have corresponded with the aduton of the Greek shrines. In the secos no representation of the human figure was permitted to be sculptured, but the walls were covered with symbolical representations of the figures of animals. This further appears from a passage in Lucian, where an observation is illustrated by a reference to "Egyptian temples, which are so beautiful on the outside, but within only contain representations of monsters."

The adytum, or holy of holies, or sanctum sanctorum, of the temple at Jerusalem, formed the smaller portion of the tabernacle. Its length, breadth, and height, were each ten cubits, and it was divided from the *sanctum* or holy, by a veil or curtain of very rich cloth, which was hung from four pillars of shittim-wood that were covered with plates of gold. In this receptacle was placed the ark of the covenant. The adytum and sanctum together formed the *tabernacle*, an oblong square 30 cubits long by 10 broad and 10 high. The adytum had no window, the tabernacle was lighted from the spaces between the columns at one end. Its three sides and roof were enclosed by planks of shittim-wood, overlaid or ornamented with plates of gold,—over these were thrown curtains—the first on the inside of a hyacinth colour, with stripes of purple and crimson; over this curtain was a curtain of goats hair, to prevent the splendid covering beneath from being injured by the soaking of rain. The whole erection of adytum and sanctum was so contrived as to be easily taken to pieces, and re-erected.

The excavations at Elora and Elephanta are also conjectured to shew traces of an adytum; and the temples of almost every Asiatic divinity are furnished with this distinction.

Ædes. *In ancient Roman architecture.* Is distinguished from temple, as being dedicated to the worship of some divinity, without a special consecration by the augurs. They have been compared to chapels. In general they differed nothing from temples except in their size and less expense of their decorations; and an inscription, placed at the entrance, which announced that they had not been formally consecrated. A great number of these buildings were spread over the different quarters of Rome.

The distinction between ædes and temple was observed among the earlier Romans, but it was latterly lost, and it is now difficult to assign a building as belonging either to the first or second classes.

Ædicula. Sometimes expresses a low and small house; at other times, a building dedicated to some deity, considered as a diminutive of the building called ædes; a niche, or tabernacle, or adytum formed in the wall to enclose a small statue of the Lares and Penates; also a votive offering representing temples, and suspended in temples, and, above all, in that of Diana, at Ephesus.

Nothing gives a better idea of ædicula, considered as a diminutive temple, than the small circular edifice by Bramante in the court of the convent of St. Peter, in Montorio, or the small monument standing in the enclosure of the temple at Pompeii, towards the angle on the right hand on entering. Of the same sort were the ædiculæ of Jupiter, Juno, and Minerva, in the capitol erected by Tarquin, and standing within the peribolus of the greater temple or in one of its surrounding courts.

Many of the buildings pointed out by antiquaries as examples of ædiculæ appear to be tombs, of an unknown character; such as the pretended *ædicula ridiculi*, erected by the Romans, in derision of Hannibal's being prevented by the cold weather from advancing upon Rome after the battle of Cannæ, which is nothing more than a tomb of the lower ages, indicated by its interior arrangement, and the small niches destined for the reception of sepulchral urns.

Ædiculus. Among ancient builders, the god who was supposed to preside over the erection of buildings, and who was especially diligent in watching over their preservation.

Ægesta. Ancient history, says Wilkins in his splendid "Antiquities of Magna Græcia," refers the origin of the city of Ægesta to a period near that of the Trojan war. Elymus and Ægestus, who abandoned Troy, when taken by the Greeks, planted a colony in Sicily, which was visited by Æneas, and joined by the Trojans, who accompanied him. This colony was named after its founder, Elymus, and the city received its name from Ægestus.

Ægesta remained under the dominion of Carthage until the time of Agathocles, who plundered it, and changed its name to Diceapolis. After his retreat to Gela it reverted to the Carthaginians. Pyrrhus afterwards made himself master of it; but when he fled from Sicily it again fell into their power. Surviving many vicissitudes of fortune, it retained its importance until the Saracenic conquest, which involving all Sicily in desolation and ruin, extended its fatal consequences to Ægesta; it was then entirely destroyed.

A doric temple standing upon the brow of a craggy precipice, to the east of the ancient boundary of the city, has survived the overthrow of the city. Any opinion as to the period when this magnificent monument of the taste and piety of the Ægestans was erected must rest upon conjecture, unless it be allowed to be the temple mentioned by Dionysius Halicarnassus as that which was built by the Trojans, who remained in Sicily after the departure of Æneas. If solidity of construction, and simplicity of style and design, be considered as marks of antiquity, this temple may be considered as of the earliest age. It has six columns in front, and fourteen in the sides, including those at the angles. These columns are unlike every other specimen of Greek architecture in the island, inasmuch as they have no flutings, and it does not appear that there ever was an intention of supplying these ornaments. The diameter of the columns at the base is about 6 feet 7 inches, and below the capital about 4 feet 11 inches. A groove is formed at the bottom of every shaft, which is supposed to have been made for the reception of *bronze* bases. The platform, or stylobate, on which the temple stands, is formed of three steps; the upper step is sculptured in a somewhat singular manner; each stone having a projecting knob, similar to those on one of the walls of the Propylæa at Athens. Mr. Wilkins remarks, that it might appear that they were left for the purpose of assisting the raising of the stones, were it not that they observe a certain order of disposition which would indicate that something more than mere convenience was consulted in forming and leaving them. Some of the stones forming the upper step having disappeared from the intervals between the columns, gives them the appearance of standing on square plinths. All the columns remain, and are nearly entire; the entablature has suffered but little, and, excepting some portions of the cornice, the pediment is almost perfect.

All traces of the walls of the cella have vanished, and the floors of the cella, and also those of the peristyles, have been taken up so completely, as to expose the bare rock on which the temple is founded.

Fig. I., on the plates marked *Ægesta*, is a plan of the temple.

Fig. II., a geometrical elevation of the front of the temple.

Fig. III., an elevation of its peristyle.

Fig. IV., the capitals and entablature to a larger scale.

From the similarity of the proportions of this temple to those of the temple of Solomon, it is conjectured, that the same principles of construction were followed in both: and, when we investigate at what period, and under what circumstances they were built, we will find a relation subsisting between them which is too particular and exact to have been the effect of chance. Æcus, the supposed founder, lived twenty-seven years after the founding of Solomon's temple.

Ægina. The gulf included within the two promontories, Sunium and Scyllæum, contains several islands, of which that called Ægina is more remarkable, as containing some remains of Greek architecture in its best ages. The doric temple, supposed to have been dedicated to Venus, is one of the most chaste and pleasing examples of this order, neither partaking of the low and heavy proportions of the temple of Corinth, nor of the tall and slender form of that of Jupiter at Nemea.

In the time of Chandler, the two columns, which alone remained of this edifice, were entire, and then supported an architrave. The upper half of one of the columns has fallen, and the architrave has disappeared. The stone of which they were composed, is of a soft calcareous nature, and the total destruction of the temple may be as much owing to this cause as to that of the concussions of earthquakes.

The temple of Jupiter, Panhellenios, after that of Corinth, is probably the most ancient temple in Greece. Mount Panhellenion, upon which the temple stands, commands a prospect of a large part of the island: the temple is placed upon a platform, that was, in ancient times, supported or formed by terrace walls, of regular construction, resting upon others, which are composed of polygon stones, and more ancient in appearance than the superstructure. Its situation is now far from any habitation, and surrounded with shrubs and small pine trees. No ruin in Greece is more picturesque, and the approach to it is exquisitely attractive.

The temple originally consisted of 36 columns, exclusive of those within the cella, having 6 at each end, and 12 at each side; being a deviation from the usual rule of doric temples, which generally have, at each flank, one more than double the number in front: within the cella were ten smaller columns, 5 on each side, which supported the roof; the lower parts of these are still in their original position; 25 columns are still entire. The greater part of the architrave is preserved, but the cornice, metops, and triglyphs have fallen. Many of the columns have been injured, by boring for metal to their very centre.

The stone of which the temple is composed, is soft and porous, and was easily worked; it was coated with a thin stucco, which must have given it the appearance of marble. The architrave was painted, and the cornice elegantly ornamented in the same manner. Most of the columns are in several layers of stones; some of them, however, are single blocks, like those of the Temple of Venus, and of the temple at Corinth. In Greece, when the columns are of marble, it is rare that they are of one piece: except the ionic pillars near the monument of Lysikrates, and the two tripodal columns above the monument of Thrasyllos, and the single column of cipolino, at Athens. In Italian temples the columns are frequently in one piece, whether of marble or other stone.

When the large blocks of stone were removed, which covered the inside of the temple, the pavement of the cella was found to have been covered with a fine stucco, painted of a vermilion colour, and about one-sixth of an inch in thickness.

The architecture of this temple approaches nearly to that of the hexastyle hypæthral temple at Pæstum: no remains have been found of the covering of the pronaos, or of the interior porticoes. The roof was probably worked in marble, cut in the form of tiles, as had been first practised in the temple of Jupiter at Olympia; an invention attributed to Byzes, of Naxos, about 580 years before Christ. The Tower of the Winds and the choragie monument of Lysikrates at Athens, exhibit some specimens of this style, which appears to have been followed by the Greek colonies in Italy, but not to have been practised or understood by the Romans, who used the Etruscan form of construction; ornamenting their brick buildings with incrustations of stucco, painting, and basso-relievos, moulded in Terra Cotta.

The celebrated collection of Ægina marbles, formed part of the decoration of this temple. They were brought to light by Mr. R. Cockerell, and the discovery in its importance has not been surpassed by any in modern times.

The figures are conjectured to represent the heroes of the Iliad, contending with the Trojans for the body of Patroclus. The bodies of some are naked, while others are represented as clothed with armour, or leather: and their attitudes are judiciously adapted to the form of the tympanum, and to the places which they occupied. In the opinion of antiquaries, they were sculptured before the era of the introduction of the *beau ideal* in Greek sculpture:—the muscles and veins, anatomically correct, exhibit the flexible softness of life, and every imitation of movement is in scientific harmony with nature. "The limbs are strong, though not herculean; elegant, without effeminacy: no preposterous muscular protuberance, no unnatural feminine delicacy offends the eye—they are noble without being harsh, or rigid, and composed with doric severity, mingled with the airy grace of youthful forms. The perfection of the finish is quite wonderful; every part is in a style worthy of the most beautiful cameo."

The extremities of the hands and feet merit particular praise. In general, the ancients thought that elegant fingers and nails were essential ingredients of the beautiful. The high finish of the hair is, also, another peculiarity; some of the curls, which hang down in short ringlets, are of lead, and still remain: the helmets were ornamented with metal accessories, and the weapons were probably of bronze: but these have not been found. All the figures have been painted—the colour is still visible, though nearly effaced—on the ægis of Minerva it is still very distinguishable. The ground of the tympanum was painted blue, probably to indicate that the action took place in the open air.

One of the most extraordinary circumstances connected with these tympanum ornaments, is the sameness of countenance, and want of expression in the faces—an unmeaning and inanimate smile prevails in all the faces—even one of the heroes, who is mortally wounded, and supporting himself in a most beautiful attitude, is smiling at death: the conquerors, and the conquered—the dying, and the dead, have all one expression—or, rather, none at all. This identity is conjectured to have been designed on account of some religious prejudice — perhaps some archaic, and much venerated, statue served as a model, from which it might have been thought irreverent, or inconsistent to deviate—for it can hardly be supposed that artists, capable of giving the greatest animation and character to the limbs, either wanted the observation, to trace the movements of the countenance, or the power of fixing them in marble.

Candelabra, made at Ægina, were valued, among the ancients, as highly as those made at Tarentum. Those of Tarentum were esteemed for their fine forms, of Ægina, for their finished workmanship. Candelabra, combining these excellencies, were of the most expensive kind, and it is mentioned by Pliny, to the reproach of Gegania, a rich Roman lady, that she had given 50,000 sesterces for a candelabrum, which was the joint production of both those celebrated manufactories

The ceramic vases of the island, were in equal estimation, and have a lustre and polish equal to those of Nola. Vases of various colours are often found here, and are interesting, from their fine forms, and great brilliancy.

Ægis. *In decoration.* A breastplate, or shield. The ægis of Jupiter and Minerva, are those most usually seen on ancient sculptures. That of Minerva is thus described by Homer: " Minerva, the daughter of Jupiter Ægiochus, sheathes herself in armour. Her shoulders she covers with the ægis, the tremendous ægis, encompassed round with terror, discord, force, assault. In the middle was the gorgon's head, the dire portent of Jupiter, the awful ægis-bearer." The ornament distinguishes kings and military chiefs; and the emperors of Rome are sometimes sculptured as wearing the gorgon's head on the breast of their armour. See *Shield.*

Ægricanes. Sculptured representations of the heads and skulls of rams, which are used as a decoration on altars, friezes, &c. imitated from the custom of suspending that part of the animals sacrificed in front of the altar; or from the friezes of temples.

Ægyci. Pointed stones, or obelisks consecrated to Apollo, and placed in the vestibules, and outside of houses, for their security.

Ægyci were sometimes nothing more than large stones, having a square, or circular basis, terminating in a point. Sometimes the head of Apollo, or Mercury, was carved upon them; or a head of Bacchus, as protector of the highways: according to some authors, they served the same purpose as our direction-posts.

Ægyptian Architecture. See *Egyptian.*

Ægyptilia. *In decoration.* A species of Egyptian ornaments, having a light blue figure or device on a dark or black ground.

Ælamoth. (Heb.) A vestibule.

Ælia Capitolina. A name given by the emperor Adrian to the new city which he caused to be built near the spot where the ancient Jerusalem stood. Here he settled a colony, and consecrated a temple to Jupiter Capitolinus.

Ælurus. *In Egyptian ornament.* The god cat; represented sometimes in propriâ personâ, and sometimes as a man with a cat's head.

Æmilius Pons. One of the bridges of ancient Rome; called also Sublicius, because it was built on piles.

Ænea. *In ancient naval architecture.* A ship armed for warlike purposes, with a brazen prow.

Æneatores. *In decoration.* Military musicians, seen on many ancient monuments, particularly on the Trajan and Antonine columns; they are further distinguished by the particular name of the instruments they are represented playing upon.

Æolipile. A hollow metal ball, with a small hole perforated in it, or having a slender pipe rising from it. This vessel, filled with water, and placed on the fire, produces a vehement blast of air.

The æolipile was applied to a sort of bellows, to blow the fire, where a very intense heat was required; and which it accomplishes, not by expelling the water it contains in the form of steam into the fire, but carrying the *air* between its orifice and the fire into contact with the fuel.

It has been proposed to fumigate, or scent rooms, by filling it with perfumed, instead of common water.

It has been applied as a curer of smoky chimnies: by being hung over the fire, its vapour causes a rapid current of air to be determined up the chimney.

Dr. Plott gives an instance where an æolipile is actually made to blow the fire. The lord of the manor of Effington, is bound by his tenure to drive a goose, every new-year's day, three times round the hall of the lord of Hilton, while Jack of Hilton (a brazen image) blows the fire.

An antique æolipile is described in the Archæologia, vol. xiii., p. 410: it is made of bronze, in a very rude style of workmanship, and its form is a grotesque imitation of a human figure. It has a hole at the back of the neck, to admit the water, and a small hole in the mouth, to occasion the blast. For some other uses of the æolipile, see *Stuart's Descriptive History of the Steam Engine.*

Æquum. An ancient city near Seign, in Morlachia. Pieces of cornices, pillars, and other fragmants of antique architecture, are occasionally found on its site.

Ærarium. (From *æs, æris*, Lat. copper, that being originally the only metal used in Roman money.) The public treasury of the Roman state. The Temple of Saturn was the great *ærarium.*

When, on account of the increase of the Roman empire, the part of the temple appropriated to this purpose was not sufficient to lodge all the money and archives of the state, an appendage was built to it, called ærarium sanctius, because formed in an inner part of the enclosure, and in which was lodged the "twentieth," kept as a fund or reserve for the extreme necessity of the government.

Æsymnium. A building erected by Æsymnus, the Megarean, upon occasion of consulting the Delphian oracle how the country might prosper, and enjoy the most prosperous government. He received for answer, that it would be most likely to be great, if it followed the counsel of the most numerous, and, conjecturing that the oracle referred to the dead, he built this monument, and encompassed it with a council-house; and thus he hoped to obtain for his countrymen wise and prudent counsel.

Ætherius. An architect, who lived at the commencement of the sixth century, under the reign of Anastasius, emperor of the east. He was admitted to the confidence of that prince, and held a principal station in his court. He designed a great many palaces for the Greek nobles at Constantinople; and, among other structures, he erected an edifice named Chalcis, within the enclosure of the imperial palace. It is conjectured that the great wall between the sea to Selimbrya, to hinder the inroads of the Scythians and Bulgarians, was erected under his direction.

Ætoma. (Gr.) A pediment; the *tympanum* of the pediment. It was at first given to the ridge or apex of the roof, and transferred to the tympanum. This part was named by the Greeks from *ætos*, an eagle, from a resemblance in its outline to an eagle with its wings extended.

Some authors confound the *ætoma* with the acroteria of the pediment; the ætiaioi were the stones forming the facing of the tympanum; probably, also, the sculptures which adorned it. See *Acroterium.*

Ætos. See *Ætoma.*

Affectation. *In architectural composition.* An unnatural or overstrained imitation or artifice.

A composition or a mansion, consisting of a single mass, may be contrasted with a variety of lines, so as to form a pleasing whole of itself; but an union, or composition of *several masses*, where *every part* is so *contrasted*, produces an assemblage of artifice as is in the highest degree *affected*. "It is the peculiar characteristic of men of genius to be afraid of coldness and insipidity, and, in their endeavours to give the utmost degree of grace, they thus fall into the most hateful of all hateful qualities, affectation." Poussin, in abhorring this species of affectation, and that want of simplicity which he observed in his countrymen, has fallen into the contrary extreme of an affectation of simplicity.

When simplicity (instead of being a corrector of affectation) sets up for herself, that is, when an architect values himself on this quality, such an ostentatious display of simplicity becomes as disagreeable as any other kind of affectation. He is, however, in this case, likely enough to sit down contented with his own work; for though he finds the world to look on his productions with indifference, yet he consoles himself that they have simplicity, a beauty of too pure and chaste a nature to be relished by vulgar minds. This simplicity, when so very inartificial as to seem to evade the difficulties of art, is a very suspicious virtue—an affectation.

The affectation of a *literal* imitation of buildings, of any style, often leads us into the greatest absurdities. "One builder smitten, forsooth, with the beauty of the old Roman manner, raises himself a house, having the outward semblance of a temple of some pagan god; and to accomplish this whimsy, he shows a door, only, in its best front; and it is well if a pair of windows is to be seen in any of the others; and these, mayhap, so placed, as if he were ashamed to show to the passers by, that he must have the sweet light of heaven to enliven some pendicle of his dwelling. Another, humbler withal, but equally touched with the leprosy of affectation, aping his betters, must needs garnish his *thatched* grange with battlements. A third will so beplaster his mudwalls with griffins and lions, and stick crockets on pinnacles, and pinnacles on juttings, that it were a hard matter to find a space ample enough to write *fool* upon, in letters no bigger than those of the good bishop Latimer's bible. And a fourth, who, like the mole, seems to live in the world without eyes, is contented to burrow in a house, so bare of becoming and seemly ornament, that when we behold it, we cannot stay feeling, 'that, in truth, the affectedness of plain building is as noisome as any of the others.'"

Agalma. (Gr.) The ornaments upon a statue, or within a temple.

Agamedes and **Trophonius.** Two Greeks, who lived in the year of the world 2600, are the first architects mentioned in the history of their country. Some authors feign that Trophonius was the son of the god Apollo; but those who have searched further into his history, say that he and Agamedes were the sons of Erginus, king of Thebes. It is certain, however, that whatever were their ties by blood, that they lived in very strict friendship, and acquired great fame by their joint productions.

Among these buildings which they erected in different places, two are particularly named. A temple, consecrated to Neptune, near Mantinea, and the famous temple of Apollo, at Delphi. Cicero relates that, after they had completed this magnificent building, they prayed to Apollo to grant them, as a reward for their devotion and labour, some gift which he considered was the most useful to man. Three days afterwards, they were found dead.

This does not, however, accord with what Pausanias has written on the subject. He says, that after finishing the temple of Apollo they were employed together on various other buildings, and among others, they constructed one at Libadea, where Hiero put his treasure, and this was the true cause of their death. Knowing for what purpose the place was destined, they dexterously adjusted certain stones into the wall in such a manner that they could be easily withdrawn and inserted; and by this means they entered and left the treasury at their pleasure. Hiero, seeing his treasure diminish every day, notwithstanding the great care he had taken to erect a secure place in which to deposit it, laid snares to discover the robbers. Agamedes and Trophonius, not suspecting any thing, entered the treasury as usual; when Agamedes thrusting his hand into one of the chests containing the money, he was fixed by the snare. Trophonius, despairing of being able to disentangle his brother, and to save him from a disgraceful exposure, and also to extricate himself from the danger of being discovered to be an accomplice, cut off his head. But so horrid a crime, continues the historian, did not go unpunished; for he had no sooner committed it, than the earth opened and swallowed the fratricide alive. Where he perished was found a deep cavern, which, in aftertimes, was much reverenced, and resorted to as the abode of an oracle. Trophonius not only gave his name to this place, but statues, and altars, and temples were raised to his honour, and sacrifices were offered to him. See *Adytum.*

Pausanias relates, that in his time were seen at Thebes, on the left-hand of the gate which is called Electra, the ruins of a house which they say was inhabited by Amphytrion, when he fled from Argos, on account of the death of Electryon. The bed-chamber of Alcmene in his time was to be seen among these ruins; which was said to be built for Amphytrion by Trophonius and Agamedes, and that the following inscription was once inscribed upon it: "Amphytrion, when he designed to marry Alcmene, chose this for his bed-chamber, which was made by Ancasius, Trophonius, and Agamedes."

Agapenor. A Greek architect, who built the famous Temple of Venus, at Paphos. No vestiges of this building are in existence; but representations of it are to be found on some ancient medals. On one of these pieces s seen a small space, enclosed by a semicircle, which probably represents the area mentioned by Pliny, on which no rain ever fell.

Agapitus. A Greek architect. Pausanias mentions his having seen a portico built by this artist among the Eliens, and which bore his name: this is all that is known of him.

Agate. A precious stone much used in decoration, for enriching cabinets and altars. The inlaid works in agate made in Florence are celebrated throughout Europe.

In A. D. 1500, when the arts of Italy may be considered to have been at their highest point of excellence, several artists had settled at Florence, skilled in fashioning agate and rock crystal into cups, vases, and other ornaments, many of which still adorn the rooms and galleries of the Florentine nobles, and which are now highly valued throughout Europe. These artists laid the foundation of another method of employing agate in decoration, which is still practised to a considerable extent at Florence.

Agate-inlaid-work is made at a manufactory carried on at the expense of the grand duke.

Agate, and other hard stones, are cut into various figures, so as to form, when put together, a flat surface forming a representation of shells, flowers, foliage, and other objects. This sort of picture differs essentially, and in many respects, from mosaic: the pieces of agate have a *considerable surface*, and are cut into the form of the outline of the object, and the colour of each piece is not uniform over its whole surface. Whereas in mosaic the pieces of enamel of which it is composed are small, and all nearly of one size and form, and generally square on the surface; and each piece is of one colour, but so placed as to represent the most minute variations of shade and tint of high-finished pictures.—Agate-work is better adapted for simple designs, composed of outline and a few colours, without a gradual blending of tints or shades into each other.

The stones chiefly employed in agate-work are, agates of a light colour, for the enlightened parts, and darker-coloured agates for the shadows. Sometimes the same piece of agate has a light and dark colour on different parts of its surface, and is used to represent a form partly in light and partly in shadow. Other stones employed are chalcedony, and jasper of different colours; lapis lazuli, and other stones, suitable from their hardness, colour, and polish: antique red porphyry is often employed for the ground of the tables, or pictures. Some stones of inferior hardness are also occasionally used; such as antique yellow marble, oriental alabaster, besides other substances, not of the mineral class, as mother-of-pearl shell and red coral.

Formerly pictures of buildings, such as views of the Pantheon, of the tomb of Cecilia Metella, of about two feet in length, and also human figures, were made in this way; but it was not at all adapted for these sort of subjects, from its being impossible to obtain gradation of shade, and the necessary details of outline; so that, after much labour and expense, the effect of a pleasing imitation is as far from being produced as in the most ordinary and cheapest engraving.

The subjects now chosen admit of a better imitation in inlaid-work—shells, flowers, vases, and grotesque foliage—they are generally disposed so as to form tables, and in this way produce a fine effect. Tablets of from four to twelve inches are also manufactured for ornaments to pannels, &c., and sometimes find their way into England, where they have often been pleasingly introduced into the decoration of chimney-pieces.

A round table of this kind, ornamented with grotesque foliage, in one of the rooms of the Florentine gallery, has been much admired: other fine specimens are in the Pitti palace, and others were in the gallery of the Louvre during the reign of Bonaparte.

The agates and other stones are slit by a bow, with an iron wire and emery, into slices about an eighth of an inch thick; the iron wire effecting the same purpose as the thin iron wheel of our lapidaries. The slices are then polished, and afterwards they are cut by the wire into the form required, for the design of which the piece makes a part. The different pieces that form the picture are put together, and cemented on a slab of sand-stone half an inch thick, which forms a temporary base. When all the ornaments of a table are done, pieces of antique red porphyry, cut into slices of the same thickness as the agates, are so adjusted as to cover entirely the table or pannel which it is proposed to form. Out of this ground of porphyry pieces are cut by the wire; and taken out exactly of the form of each picture or ornament; the pieces are then taken from their temporary base, and the porphyry ground being cemented on a slab of sand-stone, of the size of the table, the pictures or ornaments are cemented in the vacuities of the ground. The cement used is a composition of wax, turpentine, and resins.

Agesistratus. An ancient architect and civil engineer, who wrote upon the construction of machines.

Agger. *In ancient military architecture.* A military road, the middle part of a military road, formed into a ridge, with a gentle slope both ways, to carry off the water. The agger had also paths on each side for foot-passengers, with stones to mount horses placed at every ten feet, the ancients not using stirrups. At Pompeii, there are numerous mounting stones remaining.

Where highways were in low grounds, or between small hills, the Romans raised them above the adjacent land, so as almost to bring them on a level with the hills; some in Gaul were raised 10, 15, and 20 feet above the ground, for lengths of 15 and 18 miles; these were called aggeres. In the middle ages they were called aggeres calceati, latterly causeways.

Agger is also used for the works thrown up for the attack or defence of towns or camps. In this acceptation, it is the same as *vallum*, and corresponds to lines, terrasses, cavaliers, &c. in modern military architecture.

The agger was usually a bank of earth, having turrets and towers at certain intervals; and it was usually accompanied with a ditch. The earth of which it was composed was strengthened and bound by boughs, fascines, stakes, ropes, variously crossed and interwoven. In the absence of these, stones, bricks, tiles, and sometimes arms, utensils, and packsaddles, were used to fill it up, and give it stability.

The besiegers used to carry this work nearer and nearer to the walls of a place, until at length it even reached the wall. On the other hand, the besieged set fire to the materials, if of wood; and sapping and undermining it, if of earth; and sometimes by erecting a counter agger, as was done by the Gazans in the defence of their city against Alexander the Great. Vast aggers were constructed by the Romans near towns, and in places on the sea-coast, and fortified by towers and castles. The aggers made by Cæsar and Pompey at Brundusium were of this description. In fact, aggers were one of the most usual and effective defences in ancient military affairs. Tarquin's agger was a fence built by that prince on the east side of Rome, to prevent the incursions of the Latins. Criminals were precipitated from this rampart.

Agger. Earth dug out of a ditch, and thrown up on the brink of it.

Agger. A wall erected against the sea, or a river, to keep them within bounds; a dike, dam, sea-wall, &c.

Agger. A mound, or funeral burrow raised upon graves; a tumulus.

Agora. (Gr.) A market, or forum; technically, the remains of the entrance of an ancient market at Athens. The building, previous to Stuart's time, was considered to have been a temple dedicated to Rome and Augustus. Stuart remarked, that the wall in which the door was placed extended on each side beyond the lateral walls of the portico, whereas the usual plan of temples is, a rectangular parallelogram, and their lateral walls are continued without interruption, from the antæ of the posticus, or back front. Besides this, the diameter of these columns are in a smaller proportion to their height, than the diameter of any that are found in the ancient temples of this order now extant; which circumstance, considering the distinction that Vitruvius makes between the proportion of those columns which are employed in temples, and of those which are placed in buildings of inferior dignity, adds a considerable weight to this opinion.

It may likewise be remarked, that there is an appearance of impropriety, in supposing that an edict, relating to the sale of oils, was inscribed on the gate of a temple. Neither, indeed, did Wheeler and Spon, when they conceived this to be a temple, understand that the inscription, which appears to be an edict of the emperor Adrian's, was part of the building, but brought here from some other neighbouring ruin; whereas, in fact, it is in its original situation. The edict, however, could not have been placed in a more appropriate situation than on the jamb of the door-case of an agora. There were two agoras at Athens, the one called the Old, and the other the New; the first was within the walls, and the second (the one under consideration) was situated in the suburb, called Eretria; they were ornamented with monuments of the most celebrated actions of the Athenians, and with statues of those persons who had deserved well of the republic.

The first figure on plate marked "Athenian Agora" is a plan of this portico; A, the remaining jamb of the door-case, on which is inscribed the law of Adrian; B, the transverse wall in which the door is placed, continued on each side, and extending beyond each side of the portico, contrary to the manner observed in temples; C, lateral walls of portico; D, the antæ.

The second figure is an elevation of the doric portico. The apex-acroterium probably supported a statue of Lucius Cæsar.

The third figure is a side elevation of the portico, A, being one of the antæ.

The fourth figure, the capital and entablature; X, the soffet of the architrave.

The fifth figure, capital of the antæ, and section of the entablature, and section of capital of the antæ, a section of the cornice of the pediment, in which the mutales were omitted.

Agra. A sweet-scented wood, found in the island of Hainau, on the coast of China. It is used by the Chinese cabinet-makers for some kinds of ornamental furniture.

Agra Coramba. Another variety of sweet-scented wood from the same island, and used for the same purposes.

Agrigentum, now called Girgenti, one of the most celebrated cities in ancient times for the beauty and number of its temples, was originally founded by a colony from Gela, 108 years after the building of that city. It is supposed to have derived its name from the river Acragas, which, rising in the neighbouring mountains, flowed near the spot on which the city was erected. A century after the migration from Gela, Theron established himself as king of Agrigentum, and became independent of Syracuse.

The city was besieged by the Carthaginians, under Hamilcar, who was defeated with the loss of the greater part of his army; and the Agrigentines employed their prisoners in erecting those trophies which remain to this day to perpetuate their glory. Before, however, many of these buildings were completed, a second attack of the Carthaginians laid their city waste; the sanctuaries and temples were despoiled of their ornaments, and the citizens were put to the sword. Under Timoleon, who collected the citizens who had fled to other Sicilian cities for refuge, its power again began to revive, but it eventually fell under the dominion of the Carthaginians, who, in the second punic war made it their principal station. At that time its importance was destroyed.

The site of the ancient city is well ascertained from its numerous ruins still in existence. They are described as laying in one of the most beautiful situations in the island. At the foot of a range of high and picturesque mountains which bound the plain, watered by the Acragus, a low ridge of hills stretches from east to west. The southern sides slope gently towards the river, while the northern and western fall more abruptly towards the Hypsa, which here has a very diminished current. The Acragus, after winding in the plain among olive and carob trees, falls into the Mediterranean near the site of what is called the ancient Emporium.

The still and solemn calm which pervades the extent of the ancient city and its environs, and the olives, whose venerable roots have spread themselves over the prostrate habitations of the ancient Agrigentines, give an additional air of dignity and grandeur to these noble edifices, whilst their imposing style of architecture tends to strengthen the impression which a mind of genuine taste must have imbibed of the superior effect of simplicity in buildings devoted to the services of religion.

The buildings of Agrigentum were celebrated among the ancients for their beauty and solidity. After the first defeat of the Carthaginians by the Agrigentines, when the latter, elated by their victory, and the riches which it threw into their power, abandoned themselves to the most effeminate luxury. It was observed of them that they ate as if they feared they had only a day to live, and built as if they intended to live for ever.

The finest Agrigentine temple, and which ranked as one of the most splendid in Greece, was that dedicated to Jupiter Olympus; and the site of which is now distinguished as that of the temple of the Giants; an appellation not inappropriate, with reference to the immense size of the stones, with which it has been constructed, or the basso-relievoes of its fronts, which represented the fall of the Titans.

"The temple of Jupiter," says Diodorus Siculus, "is by far the most considerable in the island. The others were either burned or destroyed in the repeated sieges of the city. When the Agrigentines were on the point of putting on the roof, war put an end to their operations, and after that time the city was so far reduced in resources, that the citizens had no longer the means to finish it. The length of the temple is 340 feet, and its breadth 60; the height exclusive of its basement 120 feet. The temple is the largest in the whole island, and the magnitude of its substructure deserves particular notice. Two methods of building are practised by the Greeks. The one allows of making the *naos* the whole width of the temple, and the other of surrounding it with columns. Either method is adopted in this building for the columns are inserted in the walls of the naos, appearing circular without and square within, their periphery without is 20 feet, within it is 12 feet. The grandeur and height of its porticoes are stupendous, they are embellished with exquisite sculpture, on the east is a representation of the contests of the Giants, and on the west the siege of Troy."

The breadth of the temple, as stated by the Sicilian historian, would be very disproportionate to its length, unless its plan were arranged differently from similar structures of the same or previous ages; the proportions, for instance, which at that period were usually observed, and are found in the temple of Concord, and which is supposed to have served as a model in the construction of this temple M. De St. Non attributes the discrepancy to an error of the copyist of Herodotus, and suggests reading 160 feet broad, which will make its proportions nearly the same as those of the temple of Concord.

It has been supposed from the width assigned by Diodorus, that the temple was in antis, or of that kind presenting only two columns between the antæ; but this alteration will not assist in reconciling the want of proportion between the breadth, and length. According to the usual proportion, the width of the temple would have been about 94½ feet; and the historian would have termed the entrance *parastas* and not *stoa*, a word never applied by him in any other sense but that of open porticoes with relieved columns.

The familiar name of "temple of the Giants" is thought by some writers to have been derived from figures of giants which they suppose sustained the capitals, in the manner of caryatidæ; but such an extraordinary deviation from the usual form we can not suppose would have been left unnoticed by so minute and accurate a topographer as Herodotus, and that too in a building with which he must have been well acquainted.

The destruction of this colossal building has been complete. "On our approach to the ruins, we see them covered with the productions of the vegetable world, and olive trees the growth of centuries, find nourishment for their roots in the depth of soil, which in so many ages has been accumulating upon them: with difficulty we are persuaded that such an extensive circuit of hill and valley can be formed by the demolition of a mere effort of human exertions, and that nature has no part in causing the great inequality of the ground before us. Where the ruins have fallen more *en masse*, we still perceive appearing above the soil the ponderous blocks which formed the capitals and the epistylia of this vast building. From these we are enabled to judge of the original size of the building, and to determine that the account given of it by the historian is by no means exaggerated."

The capitals, of which three are remaining, are each formed of two blocks, jointed vertically. The height of these blocks, comprehended between the upper part of the ovolo, and 18 inches below the fillets, is about 5 feet 5¾ inches; their breadth, which included a portion of the intervallation of about 3 feet 1 inch, is 10 feet 4¾ inches, and their length 8 feet 4¾ inches. The abacus was formed of three pieces, the largest placed directly over the centre of the shaft, and nearly as wide, as the upper diameter of the shaft is 2 feet 8 inches high.

The epistylia were formed of three courses of stones, of unequal height; in the uppermost, the listel and guttæ, below the triglyphs, were included: the height of these three courses was nearly 11 feet. A single triglyph was measured with great accuracy; it was in one stone, 10 feet 2½ inches long, 5 feet 10½ broad, and 4 feet 10 inches thick.

Powerful mechanical means must have been resorted to by the Agrigentines to raise so many enormous masses to so great a height. Grooves have been cut in every block, probably to assist in the fastening; the stones which form the capital have each two, 5 inches deep, extending from top to bottom, and continuing under the capital, and made to issue at the centre of two flutings. In addition, each block has four mortise holes, to admit other parts of it. In each side of the block of the triglyph are two parallel grooves of a similar kind, which unite in a semicircular form at the bottom.

The Agrigentines were probably induced to adopt the plan of inserting the columns in the walls from the difficulty of procuring epistylia of sufficient length to reach from the centre to centre of the adjoining columns. By this expedient, the architrave resting partly on the wall might be formed of three pieces of 10 feet each in length, instead of one stone 30 feet long, which appears to have been the distance between the axis of the columns in the north and south fronts. Mr. Wilkins (*Magna Græcia*, p. 38,) did not doubt but that stones even of that magnitude could have been procured, after he had viewed the immense masses, strewn over the tract which the ruins cover, and that such probably were used in the east and west fronts, upon which all the powers of decoration seem to have been employed.

Diodorus mentions, that a man might be hid in the *flutings* of the columns. One of these measured by St. Non was 18¾ inches long in the chord of the circle, and about 10½ inches deep.

If the assertion of Diodorus may be taken as correct, with reference to the two manners adopted by the Greeks in constructing their temples, the temple of Jupiter may be called a compound of the two, or pseudoperipteral; for the peristyle is formed by the columns inserted in the walls of the naos, and the columns of the east and west fronts were insulated.

The temple of Hercules is very little less in dimensions than that of Jupiter; there are parts of the shafts of six columns remaining in their places, and a portion of the wall of the cella, and some fragments of the sub-basement, the other parts present but an immense mass of enormous blocks, piled and scattered about in a manner as if the destruction had not proceeded from man, but had been accomplished by the convulsion of an earthquake.

The temple of Juno Lucina, situated at the eastern angle of the south quarter of the ancient city, appears to have been the most beautiful, although not the largest, in Agrigentum. At the commencement of the 17th century it was very entire, but the different shocks of earthquakes, which have convulsed the island during that period, have thrown down almost half of the columns of which it was composed. In 1779, twelve of its columns were standing.

The ruins of this fine building have many enviable facilities for its future restoration, the materials have only to be raised and fixed in their places, for the corresponding stones could be discovered with the greatest ease.

The temple is raised on a stylobate of three steps, which were continued quite round. On the north, where the ground falls, it was raised upon a plinth, or plain substructure. The remains of a court are visible before the eastern portico. The length of the temple is 124 feet, and the breadth 54 feet 7 inches: the cella is 48 feet 11 inches long, and 25 feet 5 inches wide: the columns, including the capital, are 21 feet 2 inches high, and 4 feet 6 inches in diameter.

All the columns on the north side, and part of the entablature, are yet remaining entire, as are two at the south-east angle; the rest are more or less dilapidated, and have lost, along with their capitals, some of the courses of which the shafts were composed.

Two columns, one in the north and the other in the south front, have entirely disappeared. The longitudinal and transverse walls of the cella are remaining, to a certain height; that dividing the cella from the pronaos seems to have contained staircases, which are sometimes found in great temples for ascending to the rooms over the vestibule. The pronaos and posticum had each two columns intervening between the antæ, which terminated the walls of the cella.

The order is doric, and the shafts are fluted, and the chord of the flute is about 8⅐ inches; the columns are 4 feet 6⅛ inches in diameter, at the base, and 3 feet 4¾ inches at the necking, under the capital: the echinus is a foot deep, and the abacus 1 foot and ¾ of an inch. The height of the epistylia, including the guttæ and listel, is 4 feet 1¾ inches, and the height of the triglyphs 3 feet 4¼ inches.

Among the finest, as it is the best preserved specimen of the taste of the Agrigentines, is the temple of Concord. To the veneration of the body of Saint Gregory, bishop of Agrigentum, which is buried in this temple, is owing, in a great measure, its fine preservation: with the exception of a part of the entablature, on one of the sides the building is entire. The order is peripteral and hexastyle—the wall forming the cella, being perforated with six openings serving as windows to admit light to the inside. The style is doric, without a base, as in the other doric Agrigentine buildings, and of somewhat short proportion, being 22 feet and ¾ inch high, including capitals, and 4 feet 7½ inches in diameter at the base The cella was 48 feet 2 inches long, and 24 feet 9 inches wide. In measuring the intercolumnations small differences were found, which may have arisen from the position of the flutings, and which might have disappeared, by a thicker or thinner coat of stucco with which the columns were incrusted. As the stone of which these columns are composed is very porous, it was well adapted to receive this stucco, which was very generally employed in ancient erections, and, above all, in those of this city and its neighbourhood. Nothing can be more elegant than the general proportion, and taste of design of the edifice, notwithstanding the thick proportions of its columns, which are very little more than 4 diameters in height.

The restoration of this temple to its original design has lately taken place, by order of the late king of Naples; and very great attention has been bestowed upon such repairs as were deemed essential to its better preservation. The temple being originally open, it is conjectured that the entablature over the epistylia of the north and south fronts was removed, for the greater convenience of fixing the timbers of the roof, when it was converted into a church for christian worship.

On the west of the temple of Concord, are some remains conjectured to have formed part of the temple of Hercules, mentioned by Cicero as being near the forum. Only part of the shafts of one of the columns remains in its original position. It appears to have been larger than any other Agrigentine temple, excepting that of Jupiter Olympus.

The temple of Æsculapius now forms part of a modern farmhouse. Of its size, nothing can be clearly ascertained; from two half columns, and an antæ at the west, it is conjectured by Mr. Wilkins, that it was a temple in *antis*; the columns, like the temple of Jupiter Olympus, forming part of the wall: the entrance appears to have been from the east, and it is probable that the columns were insulated. From the remains of the cella, at the north-west end, there is every reason for supposing the temple had not a peristyle—and the conjecture that it was not amphprostylos is equally plausible, from the steps at the west end, beginning from the base of the columns; the columns projected rather more than their semidiameter from the walls of the cella; their diameter at a height of 4 feet 6 inches, was about 3 feet 5½ inches, the distance between the antæ 22 feet 8 inches.

That part of the suburb of the ancient city, where this temple to the God of Medicine stands, was adjoining the burial place of the citizens, while in general, the temple of this divinity was placed without the walls; it is extraordinary that a more appropriate place should not have been found for it, in this instance, than among graves and sepulchres: the temple, in its general appearance, much resembles the "Maison Carré" at Nismes.

The temple of Castor and Pollux is a small square edifice, having pilasters at the angles; and called, without any apparent reason, the *oratory* of Phalaris. According to St. Non it is of a later age than the temples we have described, from the bases, which are indicated as having been added to its doric columns; Mr. Wilkins conjectures that the order was ionic from the bases, and the method of fluting the shaft being similar to that employed in this order. The remains, according to him, (and he is at all times the best authority,) consist of two mutilated columns, and a portion of the cella. No portion of a capital could be found, and the mouldings of the cornice were so worn that their forms were not to be distinguished.

Another temple, but of a still more recent date, forms part of the Franciscan convent: besides these, innumerable remains of columns and entablatures are scattered over the site of the ancient city, and the labourers are continually discovering vases, pateræ, and other ornaments of Greek workmanship, having orange-coloured figures on a black ground, similar to those found at Pompeii and Herculaneum.

Some remains of the Piscina, constructed by the prisoners taken in the battle of Himera, are still visible, and also of the Cloaca of Pheax, constructed at the same time by the Carthaginian captives; its immense area is now converted into a garden.

Other remains, indicate the site of a theatre, and near the temple of Hercules are some traces of a forum.

The building commonly called the tomb of Theron, is a small monument, remarkable for several peculiarities, from which it has been conjectured by St. Non to be of a later date than that called the fine age of the Agrigentine art.

Its style is a strange jumble of the ionic and doric. The base is square, and the whole building rises, in a pyramidal form, to the height of 25 feet, that is, from the platform on which it stands, to the top of the frieze—the cornice is destroyed, and we have now no means of ascertaining how the building was terminated. The height of what remains is divided into two parts; the first is a plain base, or stylobate, terminating with a cornice, on which is placed the second story, having a fluted column of the ionic order at each angle, and in the space between the columns is a blank window ornamented with a moulded architrave, and filled up with pannels cut into the stone.—The columns incline at the same angle with the walls, and the lines of the triglyphs (for the entablature is doric) converge also to a point, which would appear to have been the apex of a pyramid, of which the present remains form a part. The windows, like those of some other Grecian buildings, are wider at bottom than at the top, and in this instance the lines of their jambs coincide with the inclination of the profile of the building. Another peculiarity is the flutings meeting at an angle similar to those of the doric.—The capitals are very much mouldered, but the volute, and the echinus moulding, have been protected by the projection of the abacus. The cornice over the windows is also much decayed; the building on the whole is in very good preservation,—within, it was formed into two stories.

It was undoubtedly a place of sepulture, and after the body was deposited, the entrance was shut up, and remained in this state until an antiquary searching for vases had them removed.

From the style of its architecture, Wilkins (*Magna Græcia*, p. 36) classes it among the most ancient buildings of the Grecian city, and was probably the tomb of the prince whose name it bears, as his memory was cherished among the Agrigentines, as being the most humane and virtuous of the Sicilian kings. To account for its inconsistencies, he supposes it to have been erected soon after the introduction of the ionic order, when an ignorance of its peculiarities caused them to overlook the absurdity of placing a doric entablature on ionic columns.

St. Non, and some other travellers, whose opportunities of observation were not so favourable as Mr. Wilkins's, suppose, from these inconsistencies, that it was erected in an age posterior to the siege of Agrigentum by the Carthaginians.

The walls of Agrigentum are filled with places of sepulture, excavated in their under part in the tuffa, and even to the depth of the thickness of the wall, which has so weakened them as to hasten their dilapidation: a great number of subterranean chambers and galleries, spread over the site, appear to have had a similar destination. The Labyrinth was a grand series of secret communications, surrounding the citadel, and was useful in times of warfare.

Aile. Aisle. Isle. Ile. (*Alæ*, Lat.) wings. *L'aisle de l'église*, (Fr.) the *wings*, inward side porticoes of a church; the inward lateral corridors, which enclose the choir, the presbytery, and the body of the church along its sides.

When a church is divided in its breadth into three parts, the two extreme outward divisions are called aisles, and the centre division the *nave* or *middle aisle*, although the last seems improper—and "*side aisle*" seems a tautology.

The aisles are also the inside of the penthouse, or lean-to, which is called externally a wing.

When a church, in its breadth, is divided into three or five parts, it is termed a three or five aisled church. The generality of English churches are, however, three-aisled. The west end of Durham cathedral is the only English example of a five-aisled church.

Air-holes. Holes made for the admission of air, for the purpose of ventilating apartments, or for admitting air among the timbers of floors and roofs, for preventing or destroying the dry rot. See *Dry rot*, *Ventilation*, *&c.*

Air-trap. An opening for the escape of air from drains or sewers or pipes.

Alabaster. Under this name are confounded two minerals, wholly distinct from each other, gypseous alabaster, or compact gypsum, and calcareous alabaster. *Gypseous alabaster* is found of a white, or yellowish, or greenish colour, semi-transparent, and capable of receiving a polish. Statuaries distinguish this as alabaster. When its colours are disposed in bands, it is called onyx alabaster; and when they are disposed in clouds, it is called onyx alabaster.

Gypseous alabaster is about twice as heavy as water, its specific gravity being 1·9. In transparency it is superior to white wax, allowing the light to pass through it, but not the forms of objects. By a slight calcination or baking, it is converted into plaster of Paris.

It is very easily worked, but not susceptible of a very delicate polish, and is formed by the mason into vases, columns, tables, and other ornamental furniture. In a church at Florence, thin slabs of it are used in the windows, instead of glass.

Among the ancients, the most esteemed variety came from Carmania and Upper Egypt. The alabaster used by modern Florentine statuaries comes from Volterra, and other parts of Tuscany. It is seldom procured in large masses, the largest statues not exceeding two feet in height.

It is easier to cut than Carrara marble, but it is not so durable when exposed to the weather; the sulphate of lime, which enters into its composition, being more easily dissolved by the rain than carbonate of lime, which constitutes Carrara marble.

At Leghorn there is a large establishment, where statues and architectural ornaments of this alabaster are sold; and from this mart the greater proportion of these productions we see in England are procured.

When a candle or lamp is put into a vase of this alabaster, it diffuses a mild and very pleasing light; and it is conjectured that the ancients lighted their temples in this manner, in order that the softness and weakness of the light might harmonize with the general character of the building.

The Derbyshire alabaster, of which there are splendid inlaid columns in the hall at Keddlestone, is of the same kind with the Tuscan, but not so pure. See *Gypsum. Mortar. Plaster.*

Calcareous alabaster, or calc-sinter, is a species of stalactite, composed mostly of carbonate of lime, and is found of a variety of colours, pure white, yellowish, greenish, reddish, bluish grey. It is not quite so hard as Carrara marble, yet it receives a good polish.

It is considerably heavier than gypseous alabaster, its specific gravity being from 2.4 to 2.8 times greater than water. Its transparency is about equal to that of white wax, and it burns to lime.

Calcareous alabaster is distinguished into the common and oriental, the last division containing the hardest, finest, and best coloured pieces; other distinctions are sometimes drawn from the colours being in veins, dendritic, or in concentric, undulating zones or rings: from the flowery form of its veins, a variety is called "Alabastro fiorito." The specimens from Egypt, Italy, or Spain, are reckoned the finest, the commoner sorts being procured from Germany and France. The Italian variety is drawn from the quarry in blocks, between 6 and 7 feet long, and 3 feet in diameter: and there is an Egyptian statue of calcareous alabaster, at Rome, nearly 8 feet high; and two columns of the same sort, 12 feet high, formerly decorated the vestibule of the Vatican library.

Of the Egyptian sort, the finest comes from the Thebaid, situated between the Nile and the Red Sea, near to the town of Alabastron, and is of a yellowish colour.

The Romans used the species of alabaster brought from Egypt and Cyprus, for lighting their conservatories. It was much employed for cinerary and funereal urns, and for perfume caskets.—Some antique statues have been found composed of calcareous alabaster, except the heads, which are sculptured in marble, and sometimes of bronze.

It is not generally agreed upon whether ancient writers did not make a distinction between gypseous and calcareous alabaster. Pliny, under the same term, includes both under the same alabastrites; latter authors use the term alabastrum for gypsum, and alabastrites for calc-sinter.

Beautiful architectural decorations, basso-relievoes of foliage, animals, figures, and even statues, which have all the delicacy and high finish of the most elaborate compositions, and with all the appearance of having been produced by the chisel, are formed *in moulds*.

The water of many hot, sulphureous springs rise out of the ground, of a turbid, wheyish colour, from the large quantity of chalk and gypsum which is dissolved in it. As the water cools, the earthy particles are deposited, which line the bottom and sides of the vessels in which it is contained with compact alabaster. The spring supplying the baths of St. Philip, in Tuscany, is situated on a mountain near Radicofani. This water is very hot when it first issues from the ground, and contains a great quantity of calcareous matter. Here a Dr. Vegni established a manufactory of artificial alabaster. He procured a collection of plaster casts from the finest Greek and Roman statues and ornaments, from which he made moulds in sulphur, by pouring it, melted in the common manner, over the object from which he wished to take an impression.—The sulphur mould is placed in a kind of wooden tub, open at top and bottom, and made conical, having the lesser end placed below. This tub has a false bottom, made of slips of wood, laid crosswise, in order to detain for a short period the water which dashes upon them. Just above this is a row of wooden pegs, fastened to the tub, around its whole inner circumference; on these the mould is supported; the whole is then placed under the boiling spring, and enclosed with walls, to prevent its being agitated by the wind; the water thus dashing on the moulds, deposits its earth upon them: in the same manner as in the common mode used by plasterers the liquid alabaster is made to lie upon their moulds. The hardness and transparency of the alabaster depends on the degree of obliquity at which the mould is placed, in order to receive the dashing of the water. The more vertical its position, the harder is the alabaster; but then it is not quite so white as the softer specimens. To improve its colour, the water is in some instances made to take a circuitous course, in order to allow it to deposit its grosser particles before it arrives at the mould. Even the softer casts are, however, as hard as Carrara marble, and surpass it in whiteness. The time required for these productions varies from one to four months, according to the thickness which is required to support the figures or basso-relievoes. When this has been attained, and the mould sufficiently filled, the mould is detached from the tub, and the incrustation on its outside is removed by gentle strokes with the hammer; the model is then separated by the usual means from the mould, and the brilliancy of the cast is completed by brushing it with a hair brush, and rubbing it with the palm of the hand.

Vegni succeeded in giving a fine black or flesh colour to the figures thus formed, by putting a vessel half full of colouring matter into the water before it arrives at the mould; and the same cast may have different colours imparted to it by these means, and protecting the parts so coloured from the other colouring matters.

A similar process of manufacturing ornaments and statues (generally for religious purposes) is practised at Guanvaselica, in Peru.

Alabastrites. (*Alabastrites*, Gr.) A box, or a vase, without a handle; also an unguentary, or vase, for holding perfumes, which, according to Pliny, was so named from the material of which the box was made being favourable for the preservation of perfumes. Pliny compares their form to oblong pearls. They are often seen as ornaments on tombs and tomb stones.

Alabastrites were sometimes made of lead, gold, or beautifully coloured glass and terra-cotta, and common stone of the country.

Alæ. *In ancient Roman architecture.* Recesses or alcoves for conversation or study, surrounded on three sides by seats; their thresholds were of mosaic work. According to Vitruvius, when the length of the atrium was from 40 to 50 feet, the alæ were to be two-sevenths of this length; their height was equal to their breadth.

Alba-longa, (now *Albano.*) An ancient Italian city, which was destroyed by the Romans about the 88th year of Rome. It rose into some importance in the time of Pompey, from the circumstance of being the site of a castrum prætorium, and the erection of numerous villas by noble Romans at the last age of the republic, and under the emperors.

The remains of the Latin city

can even now be easily distinguished from those of the later Roman edifices.

Among the ruins of the former are enumerated a temple of Jupiter Latialis, erected on the summit of Mount Cavo by Tarquin, in which were assembled the Latin tribes for the celebration of the festivals. A mass of immense blocks mark the site of this shrine; the stones of which have holes to receive cramps at their joints: several fragments of cornices are also visible, and parts of two columns, sufficient to show that they belonged to a Tuscan order.

The "Emissario" of the late Albano may also be referred to the Etruscan builders. (See *Canal.*) And probably also the tomb on the Appian Way, in approaching Alba, called of the Horatii: independently of the manner of its construction, this tomb has a similarity, both in its form and disposition, to that at Clusium, erected by the Etruscans to king Porsenna; it is almost impossible to mistake the taste of this people in architecture. Some antiquaries consider it to be the tomb of Pompey; and it is certain that the urn containing his ashes was brought into Italy by his wife Cornelia, and deposited in a vault in his Alban villa; but it is equally certain that it is impossible to decide on the particular spot which received it. See *Mausoleum.*

Vestiges of baths, supposed to have formed part of Pompey's superb villa, are also seen in the garden of an order of nuns.

In a vineyard of the Vegna Marzelli, are ruins of an aqueduct, and an ancient tomb, supposed to be that of Tullia, daughter of Cicero. It consists of three stories, and was formerly incrusted with marble. Many fragments of the incrustation yet remain.

In the enclosure of the abbey of St. Paul are remains of a wall, built with large blocks of travertino, of the time of Pompey, the remains of baths, which are conjectured to have been of great magnitude. In a vineyard is a ruined amphitheatre, of the time of Domitian: the first row of arches is in tolerable preservation; and also a part of an immense gallery, which has belonged to the palace, retaining some of its ornaments, which are in the style of those of the temple of Peace, at Rome, built by his father, Vespasian.

At Palazzuola are the remains of a building in fine preservation, traditionally called the tomb of Tullius Hostilius, under whom the Romans added Alba to their dominion.

Albarum Opus. Sometimes written *album opus.* "A sort of plastering, composed of pure lime, others think that it was a whitewash. That it is a kind of plaster is evident, for Vitruvius speaks of it as the substance with which they make cornices." He says the baths of Agrippa were incrusted with albarum opus, and that its surface would bear a polish almost as perfect as that of marble. See *Chunam. Cement. Stucco.*

"The albarum opus will be good," says the same author, "if the limestones be of the best kind, and slaked a long time before they are used, so that if some of the stones should be too little burnt in the furnace, by being long macerated in water, they may be dissolved and reduced to one consistence; for should the lime not be thoroughly slaked, but be used fresh, the crude particles it may contain will, when it is laid, occasion it to emit pustules; because these particles, slaking when in the work, dissolve and destroy the smoothness of the stucco. To know when it is sufficiently macerated, and properly prepared for the work, the lime is to be chopped with an axe, in the manner timber is hewn. If the axe meets with lumps, it is not well tempered, and if the iron comes out dry and clean, it shows the lime to be perishing and weak; for when it is fat and well macerated, it will adhere to the iron like glue, and this will be a proof that it is well tempered."

Alberti Aristotle, generally called Ridolfo Fioraventi, an architect and mechanician, born at Bologna: he flourished in the 16th century, and is considered as the most ingenious mechanician of his age. At Bologna, he is celebrated for having removed a steeple, with all its ornaments and bells, to a distance of 35 feet from its former situation; and he removed another in a neighbouring town to the distance of 50 feet. He was invited into Hungary, where he constructed a most ingenious bridge, and numerous other works; and for his merit he was made a knight. His reputation afterwards procured him the patronage of the czar of Muscovy: he erected several churches for that potentate in his capital.

Alberti Leoni Baptista, one of the greatest Italian architects, was born at Florence in 1398, and died in the same city about the year 1472.

At an early age he was distinguished for his application to study; while not yet arrived at the age of 20, he had composed a Latin comedy in so pure a style, that it was considered to have been an antique. At Bologna, he took the degree of doctor of laws, and was ordained priest; and at his death, he held a canonry in the cathedral at Florence. He, however, devoted himself to the study of architecture, and is with justice considered as one of the great restorers of ancient art, as well by his practice as by his writings; he was as expert in it as a fine art, as conversant in it as a science.

He measured many ancient edifices in various parts of Italy, and was the first who constructed buildings from an imitation of them as models, following the general precepts of Vitruvius. He wrote a treatise on sculpture and painting; but he is most known, as an author, for his book on architecture, which is an admirable commentary on the work of his guide and master. Architecture, however, was only one of the arts in which he excelled; for he was an able sculptor and painter; an expert philosopher, a profound mathematician, no mean poet, and an accomplished antiquary. Generous and disinterested, Alberti lived in harmony with his rivals, and his talents and amiable disposition were celebrated by his contemporaries and by poets.

The works of this great architect adorn many Italian cities; at Florence he finished the gate and corinthian loggie, the doric façade of the palace Rucellai, the choir and tribune of the church of Della Nunciata. At Rome, among other things, he repaired the fountain of Acqua Vergine, and the fountain of Trevi. At Mantua the splendid church of St. Andrea, for its duke Lodovico Gonzago; at

Rimini, he ornamented the church of St. Francesco; and at Urbino, he built a palace for duke Frederic Feltre.

Alcove. (*El-kauph.* Ar.) A recess in a bed-room, in which the bed is placed. A recess fitted up with fixed seats in large apartments. The word is often used for *bay.* An ornamental garden-building for shade or rest.

Alcoves appear to have been used by the ancients, in the form of niches, such as those described by Winkleman in Adrian's villa. At Pompeii, the front of a tomb, which stands by the road-side, is formed into an alcove with stone seats. The use of alcoves, as well as the word, (from *alcoba,*) seems to have been more immediately derived by us from the Spanish builders, and by them from their Arabian conquerors.

In the time of Louis XIV. and XV., the French architects almost invariably constructed alcoves for the reception of the state-beds; and more or less capacious to contain the whole bed, or only to admit of a part of it. Sometimes the floor of the alcove was elevated above that of its apartment by one or two steps, and its ceiling was not formed quite so lofty as that of the chamber. In rooms "of pretension," the platform was enclosed by a balustrade; in other cases, the alcove was nothing more than a portion of the room enclosed by a low balustrade, without any other distinction, within which the bed was placed; or it was indicated by columns and curtains, without any distinction being made in the floor or ceiling. This appears to have been the classical method, which is seen in some antique pictures and basso-relievoes, particularly that called the Aldobrandi Marriage: this arrangement is yet occasionally observed in Italian houses, where alcoves are common; in large rooms it is susceptible of great magnificence.

In some early English palaces and mansions, (Windsor and Hampton-court), the beds are occasionally placed in alcoves; but in modern erections of almost every dimension they are excluded; not the least objection against their use being the difficulty of properly ventilating the recess.

The Turks place their beds in a sort of alcove.

The ornaments of alcoves were formerly of the most costly and gorgeous description; generally assimilating to the style of the apartment of which they formed a portion.

It has been stated that the French architects have made much use of alcoves; the best designs for them are found in works written by architects of that nation. Le Pautre's ornaments, in three folio volumes, contains a variety of these subjects, many of them highly magnificent and well composed. Similar designs are also to be found in Blondel's treatise on the decoration of Buildings.

Alder Tree "is of all other the most faithful lover of watery and boggy places, and those most despised weeping parts, or water galls of forests." It is the *Betula alnus* of botanists, and is a native of Europe, from Lapland to Gibraltar; and of Asia, from the White Sea to Mount Caucasus.

There are several varieties of this tree: the long-leaved American alder, the white alder, the black alder the hoary-leaved alder, the dwarf alder.

The dwarf alder is a very humble shrub, seldom rising more than a foot high. The long-leaved alder rises to 30 feet, and preserves its leaves with us as late as December. The white or common alder grows to the height of 35 or 40 feet.

The shadow of these trees does not destroy the herbage beneath it; and the planting of them on the banks of rivers has been recommended, to fortify, and prevent the mouldering of walls, from the violent action of the water, to which they are subjected in those situations.

From the experience of ages, the wood of the alder is found to resist the action of the water; and in the Netherlands it is generally used for piles for the support of buildings in wet and boggy places. At Venice it is in much request for the same purpose: and the Rialto-bridge, over one of the canals of that city, is founded upon piles of this wood.

" The alder, which grows near the banks of rivers, is a wood not much used, though it has some excellent qualities: piles of this wood being drove in the foundations of edifices which are erected in marshy places, these, imbibing the humid element, of which their substance least partakes, will endure eternally, and support the most ponderous structures: this wood, therefore, which, out of the earth, can endure but a short time, will, if buried in a watery soil, last for ever. They may be chiefly observed at Ravenna; for there all buildings, as well public as private, have these kind of piles in their foundations." In another place, where instructions are given about the foundations of buildings, Vitruvius says, that if the site is found to be " infirm, soft, and marshy to the bottom, then it must be dug and emptied, and piles of *alder*, olive, or oak scorched, are to be driven in by machines very close together, and the intervals of the piles rammed with coal; after which, the substructure is to be completed in the most compact manner."

It is also valuable for those parts of pumps, sluices, &c. continually under water. It is used for cart-wheels, spinning-wheels, milk vessels, trays, trenchers, and handles of tools. The roots and knots are in great estimation, as furnishing a beautiful wood for cabinets: and the Scottish Highlanders make chairs of it, which are very handsome, and of as rich a colour almost as mahogany; that which has lain in bogs is as black as ebony: the colour of the wood is that of a burnt sienna yellow, and the grain is very uniform; it has been recommended for models for casting from; but although its surface is favourable, and being easily worked, its other properties unfit it for this purpose.

The cohesive force of a square inch is about from 9,000 to 14,000 lbs.; its modulus of elasticity about 11,000,000 lbs.; and a cubic foot of it, in a dry state, will weigh from 45 to 50 lbs.

The common alder is about $\frac{8}{10}$ as strong as oak, and rather more than $\frac{8}{10}$ as *stiff*, and as *tough* as oak.

Alder was formerly much used for pipes for the conveyance of water through pipes and dams, and for conveying water from springs. The poles from which they were made, run from 8 to 10 inches in diameter, and the bore was from 4 to 4½ inches.

The boring of these pipes used formerly to be a matter of some consequence. To those accustomed to the improved boring machinery of the present time, an account of the mode followed about 100 years ago may be interesting.

"The alder poles were laid on 'horses, or tressels,' of a proper height, to rest the augur upon while they are boring; the lathe was set up to turn the least end of the poles to fit them to the cavities of the great end of the others. The lathe being set up, and the poles cut to the length they will conveniently hold, viz. 8, 10, or 12 feet, they turn the small ends of the poles, about 5 or 6 inches in length, to the size they intend to bore the bigger ends, about the same depths, viz. 5 or 6 inches: this is designed to make a joint, to shut each pair of the poles together, the concave part being the female part, and the other part the male of the joint. In turning of the male part, they turn a channel in it, or a small groove, at a certain distance from the end; and in the female part they bore a small hole to fit over this channel.

"This being done, they bore the poles through, and, to prevent them from boring out at the side, they stick great nails at the end, to be a guide to them in boring through, although they usually bore them at both ends, so that if a pole be crooked one way, they can bore it through, and not spoil it.

"The poles being bored, they form them into pipes in the ground, in order to which they dig a trench, and prepare it with clay, to ram them in the female part, which is first bound with an iron ring, to prevent its splitting; afterwards they drive in the male part, till the groove in it is just under the hole, and pour melted pitch hot into the hole in the female part, which will flow round in the groove which was turned in the male part: by this means the junctures are rendered very staunch and close."

Alder-pipes laid in this manner have been taken up in a sound state after having been in use 130 years.

Aleatorium. *In ancient Roman architecture.* A room in which games at dice were played.

Alhambrā, or Medinat Alhamra, the red city. A fortress and palace built by the Moorish kings of Granada, so termed, according to some Arabian authors, from the colour of the materials with which it is built. By the modern Spaniards it is called La Sierra del Sol, or the mountain of the sun, because by its situation on a high mountain it is exposed to the rising and setting sun.

The country surrounding Granada is most delightful, and for the beauty of environs, the salubrity of its climate, and richness of the country, the Arabs called it the Damascus of Spain. Few places, indeed, offer a more striking assemblage of objects deserving the attention of the antiquary, the naturalist, and the artist. Vestiges of Punic, Roman, and Arabian works, mountains pregnant with minerals and marbles. Grand romantic scenes which may invite the pencil of a Poussin or Claude. The fruitful vale or paradise, as it has been called, fronting the city, is one of the finest in nature, and is computed at 100 miles in circuit. The plain is watered by numerous brooks and rivers, and in every direction there appear villages and gardens, which are adorned by beautiful buildings, trees, and plants, while the circumjacent hills and mountains, for the space of 40 miles, encompass the plain nearly in the form of a semicircle. At the extremity of this plain stands the renowned city of Granada, which, with its elevated suburbs resting on five hills, rises partly on delightful acclivities, and partly extends itself into the plain, covered with buildings occupied by a numerous population Language, indeed, can with difficulty describe, how happy, how charming it is rendered, by the softness of the air, the mildness of the climate, the bridges over the river, the splendour of the temples, and the convenience of its market-places. The city is divided by the river Darro, which flows from the east, and forming a junction with the Singaliswaters the whole plain, and which, like the Nile, after being augmented by numerous tributary rivulets and brooks, swells into a broad stream, and flows on to Seville.

In Granada there was a garden attached to every house, and planted with orange, lemon, citron, laurel, myrtle, and other odoriferous trees and plants whose fragrance purified the air, and promoted the health of its inhabitants. All the houses were supplied with running water, and in every street, through the munificence of successive sovereigns, there were copious fountains for the public convenience, and for the performance of religious ablutions; whatever, in short, could tend to promote the convenience and comfort of life, was here to be found in the richest profusion. The houses in the highest quarter of the city, which in the time of the Moors were particularly elegant, being beautifully ornamented with Damasquina work: the surplus of the abundant crops of corn was deposited in immense granaries excavated in the sides of the mountains. Granada had 20 gates.

Enjoying a still more delightful prospect, continues the Arabian topographer, on the opposite side there rises, as it were, another city—the Alhamrā, containing the royal residence. Here are seen lofty towers, very strongly fortified citadels, superb palaces, and other splendid edifices, the view of which fills the spectator's mind with admiration: here a vast mass of water, whose loud, murmuring noise is heard at a distance, flows from various springs, and irrigates both the fields and meadows: the outer walls of the city of Granada are surrounded by most choice and spacious gardens, where the trees are so thickly set, as to resemble hedges, yet not so as to obstruct the beautiful *towers of the Alhamrā, which sparkle among the leaves like stars*. No spot, in short, is without its orchards, vineyards, and gardens; and so abundant is the produce of fruit and vegetables reared on the widely extended plain, that the wealth alone of the first princes can equal their annual value.

The Alhamrā has been compared to Windsor castle, situated upon the northern brow of a steep hill, commanding an extensive prospect over a beautiful country: the sides toward the citadel are so dilapidated, or encumbered with modern buildings, that very few traces are visible of the ancient external walls. The interior of the palace is still in good preservation, and attests the romantic splendour of its ancient kings. Even in its present deserted state we recognise, in its architecture, the rank of the owner, the seat of power, and the gravity of the Arabian character.

The distribution of this interesting edifice is simple and natural; the courts, which in modern mansions are dull and unmeaning, are here so contrived as to seem a series of apartments, and the whole upon one plane throughout. Halls and galleries, porticoes and columns, arches, mosaics, viewed through the spray of falling waters, must have formed a view altogether enchanting; and, although the Arabian architects were altogether unacquainted with perspective, the architectural arrangement and address is admirably adapted to make a building appear larger in its dimensions than it really is. Instead of the costly works of classic art, the Arabian khalifs adorned their courts, and their haram, with the simple productions of nature, and blessed the God of Mahomet for having given them that purity of taste to enjoy the exquisite pictures presented by nature in all their freshness and beauty, instead of adorning their dwellings with the cold and inanimate copies even from the hands of masters. Water in abundance was distributed in every part of the palace, and they were skilled in its management: they raised it in jets, which dispersed the floating miasmata; or they made it flow from fountains, and tempered the dryness and aridity of the atmosphere. At other times it was spread out in the middle of a court in a large sheet, reflecting buildings, fountains, flowers, and the "glorious sky of Granada." The verge was bordered by white marble flags, with long narrow beds of roses ranged on either side,—a constant stream was made to flow in at one side, and out at the other, keeping the surface of the water on the same horizontal plane with the floors, "and as smooth and even as the glass floor of the hall of audience, in which Solomon received the queen of Sheba."

The doors are generally very large, and sparingly introduced. Except in the side of the edifice, towards the precipice, where the prospect is magnificent, the windows are placed to confine the prospect to the interior of the palace; and, as if the Arab architect felt the full force of the beauties with which the valley of Granada abounded, he ingeniously gave his reason for shutting them out, in an inscription placed in one of the apartments:—"My windows admit the light, and exclude the view of external objects, lest the beauties of nature should divert your attention from the beauties of my work."

The arabesques, paintings, and mosaics, which are finished with great care and accuracy, give a grace and importance even to the smallest apartment. Instead of being hung with tapestry or paper, or painted, they are covered with arabesques, which appear to have been cast in moulds, and afterwards joined together, although the joint does not appear; the ornaments, which recede from the eye, are illuminated in fine gradations with leaf gold, pink, light blue, and dusky purple; the first colour is the nearest to the eye, and the last at the greatest distance from it, but the general surface is white. A multitude of sculptures of unequal projection creates confusion; an error that is avoided throughout this edifice, where the ornaments being produced by incision, the artificial variety, produced by an almost boundless repetition, is not rendered a mass of confusion by the continuity being broken or divided by parts projecting from the general surface. In the external parts, where projections are necessary for the strength of the fabric, the line of continuity is preserved in each distinct series of parts. The domes and arcades are formed of artificial casts, which are almost as light as wood, and as hard as marble; and so perfect has been the art with which they are composed, that, after a lapse of a thousand years, they are as perfect as they were on the day in which they were constructed. The Arabs, from this specimen, appear to have been well acquainted with the properties of the carbonate of selenite.

Porcelain mosaics, of various figures and colours, covered the lower part of the walls to the height of 4 feet; and it also appears that the floors and columns were covered with similar mosaics;—a refinement unknown to their gothic contemporaries, whose barbarism was contented with halls skirted with mats, and floors strewed with straw or with bulrushes.

A most curious and interesting part of this edifice is the baths, which are still almost entire, and are precious as giving us information of the manner of constructing these buildings among a luxurious and enlightened people. A drawing of them will be found among the engravings under the word *Bath.*

Pedraza, the historian of Granada, observes, "that no monarch, whether Christian or infidel, ever possessed a more magnificent apartment than the Hall of the Ambassadors;" he might with truth have asserted that it is a most noble hall, "and arched so high that giants might keep their turbans on." The Hall of the Two Sisters, though not so large, displays more ingenuity of construction: the domes in particular are admirable specimens of architecture, and, as it has been stated, are in admirable preservation; notwithstanding the apparent slightness of the construction, the resistance is adjusted to the thrust with so masterly a tact, that there is not an instance throughout the building of a sinking, or a fracture.

The walls remain uninjured, except by the hand of man. The colours of the paintings, in which no oil has been used, on removing the particles of dust, are found to retain all their original freshness and beauty; the beams, and wood-work of the ceilings, present no signs of decay. The art of rendering timber and paint durable, and of making porcelain mosaics, arabesques, and other ornaments, began, and ended, with the Arabs of the Spanish khalifat; and spiders, flies, and all other insects, shun their apartments at every season.

The wood-work of the floor, in many parts of this extraordinary edifice, is of pine; the veneering work of the ceiling is, for the most part, of the same materials, and several parts of which, that were examined in 1809, were perfectly sound; not the slightest mark whatever of dry rot, worm, or insect, could be observed in any part. This freshness has been thought to be the effect of the trees being "lanced," or deprived of their sap at the time of felling; but it also appears probable, that the paint with which it is coated has assisted its preservation: the first coat may have been white lead and oil, the second coat brown, composed of red lead and carpenters' glue; upon this are laid other colours, in figures and foliage, which still retain their admirable brilliancy, and particularly the *white*, which is so bright and clear, that the roof of the Sala de Comares is generally supposed to be mother-of-pearl. When bricks or tiles were placed upon the wood-work, the Arabians generally put gypsum in contact with the timber.

The Spaniards attribute this durability to the timber being coated with a composition consisting of Safne glue and garlic, well pounded in a mortar; these being mixed together, with the addition of vermilion, are boiled over a gentle fire, until the glue becomes as thin as water: too much or too little boiling deprives it of its viscous quality. Planks cemented with this composition are said to adhere so firmly, as to break at any other part except at the joint. Garlic being noxious to worms, the Moors evidently mixed it with their cement, in order to prevent their depredations: it is not improbable that it was mixed with the gypsum used in the Alhamrā, which may account for the stucco work remaining uninjured either by spiders or insects.

The arches of the Alhamrā are of a pointed horse-shoe form; one arch remaining is a parabola. The walls are a mixture of clay and small rubble, and of small rubble stone and gravel, and coated with the same material: they are about 7 feet thick, and flanked by towers of the same material, 18 feet thick, and quite solid. In the walls, braces or ties are placed, chiefly of pine wood, which are buried in the wall, but are perfectly sound, having undergone no preparation whatever. Where coarse gravel was employed in the construction of the walls, pieces of pine wood were inserted at certain intervals; when soft clay was used, strands or twists, made of a species of rush, were put in; and in both cases they appear to have used the common Milha canes, and also in their ceilings: when they cased timber over with gypsum, they twisted Esparto cords round it, to bind the plaster; a practice still retained among the Spaniards of Granada, who find it of great advantage to the durability of their walls. The Arabs also appear to have driven nails into their walls to receive the plaster, which are to be seen in the Alhamrā; but they put gypsum or plaster of Paris (but not lime) in contact with the iron, which has thus been effectually prevented from corrosion.

The bricks with which the floors of the more open parts are paved, were 14 inches long and 7½ inches wide, and 3 inches deep; the under side was divided in its breadth into three parts; the middle division was sunk about an inch, forming a groove about 2½ inches wide, 1 inch deep, and 14 inches long. The intention of forming this cavity appears to have been, to give the bricks a bond in the cement, an effect which their present durability is shown to have completely attained. Where the brick pavement is laid over boarding, a stratum of potters' clay, or bricks laid without mortar, or of gypsum, is interposed, but no lime comes in contact with the wood; over this underlayer was spread the cement, in which the bricks, tiles, marbles, flags, &c. were bedded.

The entire length of the enclosure of the Alhamrā is about 2300 feet, and its breadth, which is nearly the same throughout, is about 600 feet.

"The character of the whole," says a modern traveller, "is so remote from that of any thing with which we are accustomed, that it produces unmingled sensations of pleasure and delight; and this pleasure would be doubtless enhanced by reading, and understanding with the fancy of an Arab, the poetry displayed in the friezes, architraves, and bands, in richly illuminated Cufic and Asiatic characters."

"We may judge," says the historian of the Arabian kingdoms in Spain, "what this palace had been in the zenith of the regal power of its possessors, with the courts and halls, baths and fountains, groves and gardens, in their perfection. Its inhabitants were sumptuously robed in fine linen, silks, and embroidery, glittering with gold and gems; they had gorgeous furniture, of citron, sandal, and aloes wood, ornamented with ivory and mother-of-pearl, intermixed with burnished gold and cerulean blue; vases of curious and costly workmanship, of porcelain, rock-crystal, mosaic, and sardonyx; rich hangings, flowery carpets, couches, and pillows; and the whole was perfumed with the precious frankincense of Yamen."

But, of all this splendour, nothing now remains but ruined edifices, uncultivated fields and gardens. Granada, the capital, is the skeleton of a city, where nothing thrives but monasteries, and lawyers surviving the ruin they have created. The Alhamrā is deserted, except on the days appropriated to the admission of strangers: the want of repairs, the frequent dilapidations, caused by the admission of rain and the stagnant waters, are accelerating its destruction. Thus dismantled, solitary and neglected, without the interposition of the government, a few more years may level with the ground the beautiful domes and splendid arcades of the only remaining palace of the western khalifs.

The approach is through a narrow street, still retaining its ancient name; a gate leads into the outward enclosure of the Alhamrā, the road ascending by a winding path, through a wood of venerable elms, interspersed with other handsome trees. Near the summit of the hill are the remains of a large fountain, erected by the emperor Charles V. The principal entrance to the Alhamrā exhibits to great advantage the massive architecture of an Arabian citadel.

The Gate of Judgment, so named on account of the ancient eastern custom of holding the courts of justice at the gates of the cities, has the horseshoe arch, so characteristic of Arab architecture. The gate was originally constructed of white marble, which has become in the course of so many years of a grey or yellowish cast. The mosaic tiling which decorates its top is about 3 feet 4 inches high; beneath it is an inscription in Cufic characters, consisting of a motto repeated twice, "There is no conqueror but God." Under this inscription, upon the key-stone of the arch, a key is sculptured; this was a favourite symbol of the followers of Mahomet, and answers to the cross among Christians: among the Arabians its attributes were similar to the key, the symbol of the church of Rome, of opening and shutting the gates of heaven. The door of this gate is of the wood of the palm-tree, with iron bolts. The porch of the Gate of Judgment has arches of the crescent form, and an open hand is sculptured on the key-stone, which was a symbol of the omnipotent hand of God, and believed to be a powerful defence against the enemies of the Koran; and it became the symbol of union among those Arabs who remained in Spain after the conquest of the city by Ferdinand and Isabella.

The Square of Cisterns encloses the ancient cisterns which supplied the palace and the other buildings with water, which were kept constantly filled by water brought from a hill, a mile distant. The largest of these cisterns is 102 feet long and 56 feet wide, the whole is enclosed by a wall 6 feet thick and arched over: the arch is 47 feet 6 inches high in the centre, and 17 feet 6 inches below the surface of the ground. There are two openings built circularly, 25 feet 6 inches asunder, and 3 feet 6 inches in diameter, strongly walled, and the tube is carried up 3 feet 6 inches above the surface of the ground, to admit air and light. The apparatus for discharging the water was extremely simple, a brass cock fixed at the extremity of a narrow subterraneous reservoir. This reservoir is conjectured to have been constructed with the intention of keeping the water in a constant state of coolness, which, in warm climates, is esteemed a luxury of the greatest consequence: and the ingenious manner in which this is accomplished, and the water is filtered and kept pure, and at the same temperature throughout the year, is worthy of imitation.

Advancing towards the interior of the palace, according to the practice of the Moors, the ornaments become more finished and beautiful; a custom observable even at this day among Arabs, who bestow but little external ornament on their buildings, but reserve all its riches to those inner apartments. In the Hall of the Baths, the arches spring from very light marble columns, of the same kind with that forming the floor. Mosaic tilings reach up to the ceiling; and the apertures for ventilation are formed of perforations in the shape of a star, and lined with green, glazed, baked tiles, aiding the sensation of a diffusion of a refreshing coolness. In Moorish palaces, from the frequency of ablution required by the rites of the Koran, the baths became an important part of every erection; and in their arrangement and decoration the same differences of style are observable. The apartments appropriated to the ablutions of the khalif and sultana, are finished in a most exquisite style, and the queen's bath is most richly ornamented with gilding and porcelain. The basins containing the water are of white marble, and the walls are covered to the height of the cornices with beautiful black and white mosaics. The vaulted stone roof is perforated with ventilators, which admit a soft and bland light into this most voluptuous apartment. The water was heated by copper boilers, and conducted from them between the walls into the different baths by means of pipes.

The Court of the Lions is considered to be one of the most perfect specimens of Moorish architecture in the building. It is an oblong quadrangle, 100 feet long, and 50 feet broad, surrounded with a corridor, formed of 128 columns of white marble, from which spring as many arches, supporting the upper apartments of the palace; a portico, not unlike some Gothic portals, projects into this court, with a fine stuccoed ceiling. The floor of the colonnade is laid with white marble; the columns are disposed irregularly, sometimes single, at other parts coupled, and in others in clusters of three: they are 9 feet high, and not more than 8½ inches in circumference; the larger arches which spring from them are 4 feet 2 inches wide, and the smaller about 3 feet. The capitals of the pillars vary in their designs, each pattern frequently occurring in the circumference of the court, but not seemingly placed with any design of being opposite to, or at equal distances with, those of the same model. The dado of the walls of this court is formed of a lining 5 feet high, of brilliant yellow and blue mosaic tiling, with a border, containing the often repeated sentence, "There is no conqueror but God," in blue and gold. The arches are further ornamented with a profusion of high-finished arabesques, having no trace of animal or vegetable forms, and surmounted with the usual inscription; a highly-decorated cornice runs round the whole court. In the centre of the court, the celebrated Fountain of the Lions is placed. These animals are twelve in number, and support on their backs an alabaster basin, richly decorated, and from which rises a smaller basin. A great volume of water rose through pipes into the upper basin, which fell into the larger fountain, and was conducted through the lions' mouths into the large reservoir of black marble. From this, as a fountain-head, the water was distributed, by means of marble channels, through various apartments. The ancient work of this court, which is out of reach of hands, is sharp, clean, and white, and not a spider's web, or insect of any kind, could be discovered in it, while some of the stucco work executed by latter kings was covered with cobwebs in many parts. The wood-work of the Arabs in this court is also in good preservation; while much of that which has been placed here by succeeding kings is fast disappearing.

From the Lions' Court is a passage to the Hall of the Two Sisters, so named from two beautiful pieces of white marble forming part of the pavement on each side of the fountain; they are 15 feet long, and 7½ broad, and quite free from crack or stain. The walls are decorated, from the pavement to the rise of the arches, with the usual elegant mosaics; the pannels between them are filled with a delicate ornament, which, at a little distance, has the appearance of a plain face; the ceiling is composed of stalactites, in stucco, and finished in a style of great elegance. The four balconies of this sumptuous apartment were appropriated to musicians, the women of the haram sat below, and a *jet d'eau* in the middle diffused a refreshing coolness through the hall. The windows look into a little myrtle garden.

Opposite to this sala is the Sala de los Abencerrages, so named from some noble Arabs, who were put to death in it by one of the kings of Granada. It appears to have been a central saloon, opening a communication to the other parts of the palace. Every possible variety of combination which can be devised by ingenuity and patience are found on the walls and ceiling; the lines regularly cross each other in a variety of directions, and return again to the point from which they were first projected. The extraordinary designs are thought to have been produced by pouring prepared gypsum into moulds, and after it was applied to the walls, by painting them with gold, azure, and purple.

The Concert Room of the Baths is a lofty saloon, in which the royal family listened to the concerts of musicians, stationed in an elevated tribune, while the audience sat below on rich carpets. The columns are of white marble, and the mosaics between the columns are black, green, yellow, and white, set in a green border; the roof is covered with tiles, and the wood-work richly ornamented, especially the three lattices or windows.

The Hall of the Ambassadors is termed, by the Arabs, the Golden Saloon, and was appropriated to the reception of ambassadors; it is 64 feet high, and 36 feet square; the materials of the walls are pebbles and red clay, intermixed; they are 15 feet thick on three sides, and on the fourth side 9 feet thick; the ceiling is composed of strong pieces of larch, in admirable preservation, which are keyed and fastened together in such a manner, that, on pressing the feet on the centre of the ceiling, the whole vibrates like a tight rope. The roof is formed of a scantling of 10 inches square deal, and laid close together, with cross braces at the angles. Bricks are laid on these rafters, and upon them is a coating of lime; on these are placed the bricks and tiles, forming the exterior covering of the roof.

The principal entrance to this noble hall is through an arched door, decorated with a profusion of stucco arabesques, in blue and gold. The floor is inlaid with mosaics, and different patterns of the same kind of work cover every part of the walls in figures and inscriptions, in Arabic, formed with porcelain with admirable skill, and which is made to form a most harmonious combination with the stucco ornaments. On the cornices are found the usual inscription. Its bold, arched ceiling is adorned with almost innumerable chiligon mosaics, knots, and other ornaments; and gold, silver, and azure purple are the colours covering the stuccoed facets.

Inscriptions are placed every where; and, indeed, the Alhamrā in general has not improperly been called a collection of "fugitive pieces." Over the principal door of the Hall of Ambassadors is inscribed: "By the sun, and its rising brightness; by the moon, when she followeth him; by the day, when she showeth her splendour; by the night, when it covereth him with darkness; by the heaven, and him who spread it forth, by the soul, and him who completely formed it—there is no other god but God."

In an inscription, on a frieze over the upper windows of the grand saloon, the letters are about 16 inches high, and left white; the ornament light blue, and the back-ground vermilion. The foliage is imitated from the small caltrops, indigenous in Spain.

Alioti, J. Baptista, an Italian architect, was a native of Ferrara. In his youth, the poverty of his parents obliged him to follow the employment of a mason's labourer. But in this humble situation he was fortunate to attract the notice of a patron by his attempts at architectural composition. He studied geometry and the belles lettres, and his subsequent diligence amply supplied the time he lost in his youth. He was a party in the famous hydraulic controversy, which arose on account of the measures for preventing the inundations of the provinces of Ferrara and Bologna. He erected a fortress at Ferrara, for pope Clement VII. And at Mantua, Modena, Parma, and Venice, he was much employed by the nobles in their palaces, and also in theatres and other public buildings. He died in 1630.

Alipius, an architect who lived in the fourth century, was commissioned by the emperor Julian to rebuild the temple of Jerusalem; but, according to the Jews, when he was laying the foundation, the earth emitted fire, and destroyed the workmen!

Alipterion. *In ancient Roman architecture.* A room used by the bathers for anointing themselves.

Alkoranes. *In Persian architecture.* High, slender towers, attached to Persian mosques, and surrounded with balconies, in which the priests recite aloud prayers from the Koran at stated times, and announce the hours of devotion to the worshippers. They are often of very fantastic shapes, and generally form the principal embellishments of the mosque. They are beautiful objects in the grouping of Persian scenery.

Allesi, G., an Italian architect. He was much employed at Genoa; and his designs for the Escurial were preferred to those of all the other artists who were competitors on this occasion. He was born in A. D. 1500, and died in 1572.

Alley. (*Allée*, Fr.) An aisle; any part of a church left open for walking through; a passage in towns narrower than a street; a walk in a garden.

Almehrabh. *In Arabian architecture.* A niche in a mosque, marking the direction of the temple at Mecca, to which Mahometans turn their faces in praying.

Almonry, Almery, Aumery, Ambrey, Aumbrey. (*Almonarium*, *Almeriola*, Lat. *Armoire*, Fr. a closet.) A cupboard, closet, or recess, so called from the hospitable, old custom of setting aside broken victuals in a particular place, to be given as alms to the poor. A pantry; a place where utensils used for culinary purposes are kept; a stone house near the church, in abbeys, or by its gates, with various offices, for distributing the alms of the convent, and for the habitation of the almoner.

In Durham abbey, in the wainscot behind the altar, were 4 grand *almeries*, to preserve the chalices and silver cruets.

Alms-house. A house devoted to the reception and support of the poor. A house built and endowed for a particular description of poor persons, by wealthy and charitable individuals.

When our Anglo-Saxon kings dined, the poor sat in the street, expecting the broken meat. Alms-houses were afterwards built at the doors of churches and abbey gates, for the distribution of alms. See *Almonry*.

Altar. *In ancient Roman architecture.* A place on which offerings or sacrifices were made to the gods. It was called *bomos* by the Greeks, in a general sense; *aræ* and *altare* by the Romans. Some pretend to find a different meaning in the two words, "aræ" being consecrated to the celestial and infernal deities promiscuously, but the "altaria" to the celestial gods only. Others make a further distinction. The gods of heaven had altars raised from the earth; the terrestrial deities had offerings made to them on the earth itself; and to the infernal gods a hole was dug in the ground. Porphyry's classification differs but little from this. He says, hearths (foci) of one step high were erected to the terrestrial deities and heroes; to the infernal gods they dug holes; and to the world and nymphs, and such like divinities, they erected or excavated grots.

The use of altars must have been as ancient and general as the use of sacrifices and offerings; and were erected in temples, porticoes, peristyles, in the open air, and on the summits of mountains.

The larger temples had generally three altars: the first placed in the sanctuary, or adytum, at the foot of the divinity; the second at the door of the temple; the third was portable, and called anclabris, on which were placed offerings and the sacred vases.

"Some altars were called, by the Greeks, *empuroi*, designed for sacrifices made by fire; others were called *apuroi*, without fire; and *anaimaktoi*, without blood, upon which neither fire nor blood could lawfully be placed, but only cakes, fruits of the earth, and inanimate things. Paphian Venus had an altar, which was said to be *free from blood, (anaimaktos,)* as it was unlawful to offer animals upon it, but not *void of fire, (apuros,)* for the goddess was worshipped *solis precibus et igne puro*, as Tacitus affirms."—Potter.

And in early times they appear to have been formed of any material admitting of a convenient or rapid execution—a mound of turf, a heap of stones. The altar consecrated by Jacob at Bethel, was merely the stone on which he rested, and that of Gideon was of a similar kind. The first altar erected by Moses was made of earth only.

The altar which Moses commanded Joshua to build was of unhewn stone; Solomon's was of brass, but filled with unhewn stones; that built by Zerubabel and the Maccabees, of rough stones.

Among the seven wonders of the world, was an altar at Delos, which was made of the horns of animals; tradition reported that it was constructed by Apollo, with the horns of deer, killed in hunting by his sister Diana. Plutarch says he saw it, and that he admired the wonderful interlacing of the horns of which it was made, and that no bond or cement was used to hold it together. In the magnificent temple of Jupiter, at Babylon, there was an altar of massive gold. The altars used by the Greeks and Romans were of bronze, but the greater number of stone or marble, bricks, &c. Pausanias mentions one of wood, made so artfully as to appear to have been built of stone.

Some altars were solid, and some hollow, from the top downward, pretty low, to receive either the libation or the blood of the victims; others again were made of iron bars only, like that on the column of Antoninus.

A grand altar for the burning of the sacrifice is to be seen at the Pamphili palace, at Rome; where is remarked the fireplace, on which charcoal was put to consume the victim, and other passages, for the escape of the blood.

Altars vary almost to infinity in their forms and size, as well as in their decorations. Their shapes were innumerable: cubes, parallelograms, frustra of cones, of pyramids, and polygonal pyramids, and portions of cylinders, &c.

The earlier altars of stone, on which were placed fruits, perfumes, or such like offerings, were probably small; but when mankind began to show their respect for their divinities, by immolating living beings, they necessarily were formed of larger dimensions.

There was no fixed standard for the height of the altar, some of them not being so high as the knee, while others reached to the waist of the sacrificers; some again are higher, and especially the round ones, so that sometimes an altar can hardly be distinguished, on basso-relievoes, from a column. Vitruvius says, their highest altars were for Jupiter; and Pausanias relates, that the altar of Olympian Jupiter was about 22 feet high.

Altars were ornamented with a reference to the attributes of the god to whom they were consecrated.

"The most ancient altars," says Potter, "were adorned with horns, the figures of them upon Roman medals are never without horns, and the altars which remain of old Rome, have always this ornament. Moses was commanded to erect an altar with horns; these horns served for various uses, the victims were fastened to them, and suppliants fled to them; some derive them from a practice of the earlier ages, wherein horns were a mark of dignity and power. The images of the most ancient gods and heroes have horns, also on heads of Persian kings; also Astarte, one of the Phœnician queens, used to wear upon her head bulls' horns."

On some are seen sculptured heads of animals, patera vases, instruments of sacrifice, garlands of flowers, in imitation of those with which the victim was adorned. Other altars bear inscriptions, stating the period and occasion of their erection, the motive and name of the person who dedicated it, and the name of the divinity. The finest altars, however, which have reached our times, are those decorated with figures, representing the gods and heroes.

On solemn days, altars were adorned with branches and leaves of trees, giving to each deity the leaves and branches which were sacred to him: to Jupiter the beech; to Apollo the laurel; an olive to Minerva; the myrtle decorated the altars to Venus, and a poplar those of Hercules; while those of Bacchus had the ivy strewed over them, and Pan was supposed to be pleased with the leaves of a pine-tree; and these were transferred by sculptors to their works as characteristic ornaments, and peculiar to the divinity to whom the altar was consecrated.

"Altars should regard the east, and be always placed lower than the statue which is in the temple, that the supplicants and sacrificers may look upward to the divinity, and stand, as decorum requires, at a different height to the god. The heights of altars are so adjusted that those of Jupiter and all the celestial gods, may be disposed as high as convenience will admit. Those of Vesta, and the gods of the earth and sea, are situated lower." —Vitruvius.

It is probable that they were always placed at that end of the temple opposite to the entrance, by that means leaving more room for the sacrifices, and causing the whole assembly to stand before the image of the god, not partly behind it, and thus giving to the whole an appearance of more dignity; and in camps they were placed before the tent of the general.

The ancients had little altars in their houses, dedicated to the Lares and Genii, and to the Junones, which were the genii of women; others were set up in the fields, and dedicated to rustic deities; these the peasants made of turf. Sometimes altars merely denoted places set apart for prayer; but wherever an altar was erected, there the god to whom it was dedicated was considered to be more especially present.

A great many sepulchral stones have been found, bearing the name of altars; and they are supposed to have been used as such, and that libations were poured upon them for the souls of the deceased. In some of them there are holes at the top to receive the libation.

Oaths and treaties among the ancients were made at the altars; and when they swore, they touched the altar, to make it more solemn: marriages were also here celebrated, and friendships contracted.

Altar of burnt offerings in the Temple of Jerusalem. A coffer of shittim wood covered with brass placed before the tabernacle, having a fire continually burning upon it; at its four corners was an appearance of something like horns. In the hollow was a brass grate on which the fire was made, and the ashes fell into a sort of box or drawer; this grate was suspended by four chains or rings proceeding from the horns of the altar; the entire apparatus was movable.

Altar of incense. A small table covered with plates of gold, on which was placed the smoking censer, in the temple at Jerusalem

Altar, among Romish Christians, is a square table, usually placed at the east end of the church, for the celebration of mass.

It is totally different from those of the pagans we have been describing, and its established form has its origin from the institution of the sacrament having been given at a supper table.

"The high altar, as it represented the church, had four corners, because the gospel was extended through the four quarters of the globe; its dimensions are stated by bishop Hakewill. 'Allowing, then, an altar of three foote and an halfe high, and a rising to it from the lower floor of a foote high, the height of the altar from the lower floor will be foure foote and a halfe, or three cubits; which is the measure required in the Levitical law, and yet differs little in height from the altars in forraine parts, or those which are yet standing with us, if wee likewise take their height from the lower floore, which, by reason of the continued and easie degrees of ascent to them, may not unfitly be counted their basis or foote.' The authentic mark of an altar table was its five crosses. —As no altar could be consecrated without relics, there was a small stone, called 'sigillum altaris,' by which the aperture for insertion of the relics was closed up by mortar, tempered in holy water. The horns of the altar are supposed to have been called the corners. Ducange says, the horn of the altar is the side where the epistle and gospel were read. The *ciborium*, an arch over the altar, supported by four lofty columns, imitation of the propitiatory, which covered the ark; it was sometimes illuminated and adorned by tapers. When there was no ciborium, a mere canopy was suspended over the altar: this was most common in English churches; a fine stone screen forming the back of the altar, from which the canopy projects. Curtains, called the *tetravelum*, were annexed, and drawn round, that the priest might not be confused by a view of the spectators. Under this ciborium or canopy hung the pix, or box of goldsmith's work, containing the host, commonly called a dove, esteemed so sacred, that, upon the march of hostile armies, it was especially prohibited from theft; and Henry V. delayed his march for a whole day, to discover the thief who had stolen one. A common altar-piece was a picture of the general judgment, called *mappa mundi;* but others occur, though it is probable no subject was admissible which was not either contemporary with, or posterior to, the passion of Christ. Over the altar was put the *palla*, carried out against fires; and over the *pall* the corporal, always made of linen, according to an order of Sextus in A. D. 133. The antependium was a veil, which hung before, as the dorsale did behind it. Behind, and about the altar, were posticæ or beams, ornamented, at the great feasts, with reliquaries of ivory and silver, &c. The *piscinas*, or sinks, where the officiating priest emptied the water he washed his hands in, and where flies, (because the emblems of unclean thoughts,) and other filth in the chalice, in short, all consecrated waste stuff or that could be so, were poured out: it was directed to be affixed either to the wall or pensile, and water was furnished with a linen pall. The *lavatory* is also called the horn of the altar. Piscinas are sometimes double, sometimes single. Besides the piscinas, were the stalls, where the officiating minister retired during parts of the service performed by the choir. The *sedes majestatis*, a seat by the side of the altar, in which he who is about to celebrate mass sits, while some parts of the service are sung."

In the infancy of the church, and while christianity was oppressed and persecuted, wood was admitted into the construction of altars, as being more portable, and convenient than any other material; but, upon peace being granted to the christian world by Constantine, the great altars were erected of stone; and the council of Hippo, at which the famous St. Augustine was present, forbids them to be consecrated in future, unless of this material. About A. D. 315, pope Sylvester decreed that stone altars should every where be brought into use; yet he suffered the old one to remain in the Lateran church, as a memorial of ancient usage, where at this day it remains. The wooden altar of the martyrdom, mentioned by Erasmus, in Canterbury cathedral, may have had its stone super-altare inserted, as was the custom, and in effect became one of stone. The portable altar was so fitted, and was, when the stone was taken from the wood, deemed to have lost its consecration.

The table forming the altar was often supported by a single pillar, like those seen in the undercroft chapels of St. Cecilia at Rome; at other times they had four pillars, similar to the altar of St. Sebastian, in *crypta arenaria:* but in the first ages of the church the custom was to place the table upon a tomb, in memory of the primitive Christians having held their assemblies in the catacombs, and in erecting an altar, great attention was paid to enclose in it the remains of some saint. This general form is exactly preserved in catholic altars, even when they are constructed with a mass of wrought masonry, adorned with sculptures and other ornaments.

These altars are further classed among architects into attached or isolated. The attached altars are generally placed against a wall, the decorations of which are so managed as to appear to form the ornaments of the altar. These are pictures, basso-relievoes, precious stones, marble, draperies, gilding and painting. The isolated altar has no sort of connection with any part either of the building or of its decorations. The high altar is always isolated, whether it is placed at the end of a church or in its centre.

In catholic countries, the situation of this altar has been much canvassed; those who place much importance on affording to a great number of spectators a sight of the ceremonies, think that the altar should be placed in the centre. Others again, who are more anxious to impress the spectators with the solemnity and sanctity of the service, would rather withdraw the altar from their immediate inspection, and place it, according to the ancient method, at the end of the church, or sacrarium, so that the distance of the point of view should heighten the effect of the splendid ceremonial. These reasons, however, are not those which influence in a great degree the choice of the architect, but rather the aptitude of the two situations to allow the most favourable opportunities for the decorations.

There can be but little question, that, if the position of the *high altar* ought to be decided by a reference to the form of the church, rather than to a particular situation admitting of some facilities or caprice in decoration, its proper situation will be in the centre of a church, having transepts; since it is to this point that all the views tend; a consideration paramount to all others. In churches built in imitation of Basilicæ, or without transepts, it should occupy the centre of the hemicycle, whether the choir and stalls are placed before the altar, or in the circular part forming the tribune, as is practised in the Basilicæ of Rome In fine, the general aspect and point of view of the greater number, ought to be the sole consideration in deciding on the situation of an altar in all churches

The desire to embellish the altar, and to fix admiration by its richness and magnificence, has given rise to innumerable accessories and decorations, which do not at all times produce the effect for which they were intended. The most ancient altars seen at Rome, in the Basilicæ, are surmounted with what is called a ciborium, a kind of small cupola, supported by four columns; to the ciboria succeeded the baldaquin, which is only a more pompous and magnificent ciborium: but the word is used oftener with a reference to the canopy, and its ornaments, of an isolated altar in the centre of a church, or standing in a hemicycle at the end; such as those in very ancient churches. The attached altars are susceptible of equal, if not greater, magnificence than the other, from the gorgeous decorations of columns, paintings, sculptures, mosaics, and precious stones of the recesses or walls, in or against which they are placed. The altars situated in a hemicycle, as they partake of both characters, so their ornaments are oftener misapplied than in the others, forming a vast frontispiece, of which the taste, and form, and ornaments, are at total variance with the other parts of the edifice. In fact, this remark may too often apply to every species of altar.

Whatever be the situation of the high altar, *its dimensions ought to be considerable, and its decorations simple.* Since the figure of a tomb is that which accords best with the received usage, and with the opinion of the origin of the rite, there is nothing to prevent a selection of forms from the most beautiful antique sarcophagi. If the altar is placed in the centre of the church, it should be raised on a grand platform, with steps on every side to ascend it, having magnificent candelabra placed at its sides, according to the ancient Roman method, to adorn and illuminate the enclosure, and a single pyramidal tabernacle over the altar; the most severe and chaste taste should preside over this holy decoration, for a gravity and simplicity ought to be its characteristic; all little ornaments and conceits, and prettinesses of every kind, ought to be excluded, as dishonouring the holiness of the mysteries, and withdrawing attention from objects to which it ought to be directed and fixed.

The altar placed at the end of a church, is susceptible of the most happy decoration; but it ought always to have a reference not only to the situation, but to the subject. A statue of the *saint*, after whose name the church may be called, may be appropriately placed at the bottom, over the altar, like the group, over the altar of St. Mary, of flowers, at Florence, or in the cathedral of Notre Dame, at Paris; or the altar of the Virgin, at St. Peter's, Rome, which forms a point of view as noble as it is interesting. A *cross* elevated over the altar, surrounded with figures whose action and expression appear directed to this object, would be both in good taste, and becoming. But, in the choice of decorations of all kinds, the simplest will be found to be the most conformable to religious feeling, as well as to the best taste in architecture. This noble simplicity, which is the very perfection of art, is totally opposed to the usual decorations of misplaced and distorted columns, niches, pediments, cartouches, statues, pedestals thrown here and there, and other similar ornaments.

In the *Lutheran churches*, the altar is also in form of a table, and placed at the east end of the edifice; occasionally raised a few steps above the floor of the building, and sometimes enclosed with a balustrade, or railing. Comparatively speaking, there are but a small number in which the taste for even becoming decoration has been shown in their construction.—The greater simplicity of the reformed worship, addressing itself more to the understanding than to the eye, has discouraged, or rather has not encouraged, any decided attempt to add importance to its ceremonial, by the decorations of painting and sculpture.

How far the altar, says a clergyman of the church of England, ought to be ornamented, is a question which has been debated with much warmth since the Reformation. The Latins, Greeks, and even the Lutherans, are accustomed to adorn it, with more or less splendour or gaudiness, according to their taste and opulence. The church of England, when not overawed by the clamours of the sectaries that assail her on all sides, is inclined to favour this practice, while the Calvinistic school of Geneva, hostile to every thing that delights the eye, or flatters the feeling of a polished mind, have either cast the table of the Lord out of the church, or stript it of all its decent accompaniments, and abandoned it in a corner to dust and cobwebs. But whatever a man's opinion may be upon this subject, he must be very morose indeed, if he find much to blame in the Roman altars, in the basilicæ, which, unencumbered with tabernacles, reliquaries, statues, or flower-pots, support a cross and six candlesticks; furniture which is sufficient, without doubt, for all the purposes of solemnity, and yet may be endured even by a puritan. The other ornaments, or rather superfluities, which are too often observed to load the altars of Romish churches, owe their introduction to the fond devotion of nuns, or nun-like friars, and may be tolerated in their conventual oratories, as the toys and playthings of that harmless race, but ought never to be allowed to disfigure the simplicity of parochial churches and cathedrals.

In a few recent instances, some attention has been paid to obtain a pleasing effect, by a picturesque distribution of light in the recess in which the altar or communion-table is occasionally placed.

The altars of *Greek churches* are equally barren of sculptured and painted ornament with those of the Lutherans, although, in every thing relating to the costliness of the sacred utensils and vestments, the Greek Christians vie in splendour with those of the Romish communion.

In the convent of St. Nicholl na Perrera, the church is lofty and spacious: the table for the sacrament, as in all other Greek and Russian churches, is kept in the sanctuary, behind the altar, where women are not permitted to enter. "The archbishop," says Dr. Clarke, "who had visited our English church at St. Petersburg, observed that our table was uncovered, except when the sacrament was administered; a degree of economy which he expressed himself unable to comprehend, or to reconcile with the piety and liberality of the English nation. What would he have said had he beheld the condition of the communion-tables in some of our country churches? In Russia they are always covered with the richest cloth which can be procured, and generally with embroidered velvet."

In *Calvinistic churches*, the name as well as the uses of an altar are unknown, either as an appendage or as a decoration.

Altar-piece. The entire decorations of an altar. A painting placed behind the altar; the ornamented mural partition, separating the altar from the presbytery, or lady chapel.

Altar-screen. The back of the altar, from which the canopy was suspended, and separating the choir from the lady chapel and presbytery. The shrine or tabernacle-work enclosing the painted or sculptured altar-piece.

The peculiar embellishment, so called in English churches built in the middle ages, "has its date of introduction not anterior to the close of the 13th century. It was first introduced in the canopies of sepulchral monuments placed over tombs, upon which the effigy was recumbent. These were afterwards enlarged into sacella, or burial chapels, for the celebration of obits, and where prayers for the dead were offered up.

The altar-screen was generally of stone, and composed of the richest tabernacle-work, of niches, finials, and pedestals, supporting statues of the tutelary saints. The high altars of Winchester cathedral, St. Alban's abbey and new college, are fine examples of this embellishment. During the Reformation, many of these exquisitely wrought altar-screens were destroyed or defaced; those that were spared being filled up with mortar, or covered with wainscot. In all these altar-screens (or altar-pieces) we observe a door placed on each side the altar; they were used by the officiating priests for the purpose of retiring to change their vestments, which were deposited in a small room behind. The statues placed in the niches were sometimes of silver or copper gilt, at other times of wood, stone, or marble.

Alto-relievo. (Lat.) High relief; that kind of sculpture which projects from a surface to which it is attached, nearly as much as if the objects were isolated and perfect.

Alur, or **Alure.** (*Aller*, Fr. to go.) An alley; a balcony.

Ambitus. A space round every tomb which was considered to be sacred. "Some ancient inscriptions on tombs are maledictions on those who violate or defile this sacred space, by untrussing thereon. In the sepulchre of Caius Cælius there is written, '*Qui hic minxerit aut cacerit habeat deos superos et inferos iratos:*' to prevent which profanation Tremalchius says he would leave it in his will that a boy should look after his sepulchre."

When this term was used in descriptions of subterranean tombs, it designated a small niche or excavation made in the wall to receive an urn or body. When it enclosed the corpse, the mouth of the niche, or excavation, or receptacle, was fitted with a slab of marble or porphyry, fastened with iron cramps, and cemented with plaster, to prevent the exhalations issuing into the streets. The engravings marked *Ancient Roman Ornament*, are representations of the inside of ancient Roman sepulchral chambers, having niches or recesses, or *ambites*, both for containing the urns and those for the bodies, which fill up the sides of the apartment. The tile or slab, covering the opening to the tomb, is shown placed at the bottom of the niche. These slabs were sometimes inscribed with the name, age, and quality of the deceased; at other times the inscription was placed over the niche, or upon the urn. The recesses themselves were often highly decorated.

Ambo. (*Ambon*, Gr. a rostrum.) A raised platform; a pulpit; a reading-desk; a *marble* pulpit; an oblong enclosure in ancient churches, resembling, in its uses and position, the modern choir, in which were performed some parts of the ritual.

The ambones, it is supposed, were sometimes built upon the screen or rood-loft.

Two *ambones,* (or *ambos,*) or ancient pulpits, are seen in the cathedral of Salerno, placed one on each side of the nave before the steps of the chancel; they are both of marble, the largest is covered with beautiful mosaic, and supported by twelve corinthian pillars of granite.

In the basilica-church of San Lorenzo at Rome, are two ambones, ornamented with round slabs of red porphyry, and green serpentine of the statuaries, and the twisted column with gilded mosaic for supporting a large wax candle, painted with foliage and ornaments, which is lighted at Easter and other times, and called the paschal candle.

The interior distribution of the ancient basilicæ, and larger churches, was into nave or sanctuary. The former comprehended the middle area from the great entrance to the steps, whose rise led to the latter. The eastern termination was semicircular; the centre of this circular recess was occupied by the bishop's seat; the presbyters' thrones were placed on his right and left. In front of the presbyterium was the high altar. In the upper part of the nave was placed the oblong enclosure, denominated the *ambo,* or chorus canonicorum; on each side, and generally attached to it, was a marble pulpit, one for reading the gospel, the other for the epistle. Near the former was a pillar for supporting the paschal candle, still remaining in the churches of St. Clement and St. Paschal at Rome. The *cleri* officiated within the limits of the ambo, as did the presbyteri in the more sacred functions of the altar. It differed in one particular from the modern cathedral choir, as the people were excluded from it.

The first mention of it is about A.D. 361, and in A. D. 705, an ambo was reconstructed in St. Peter's church at Rome. The abolition of the ambo was neither entire nor uniform at one period, but it seems to have been taken away gradually, as churches were repaired or refitted; as in that of St. Paul's in Via Ostense, so late as the time of Sextus V. The reason for removal has uniformly been the gaining room in the area of the church, except where restrained by the memory of some obsolete service or custom; of this a circumstance in the history of the basilica of St. Nereo is an instance. Cardinal Baronius being rector in A. D. 1595, finding it in decay, he restored the *ambo* with the presbytery, confessional, and *ambones* for reading; or, as the inscription expresses it, "that as the glory of God is valued, nothing may be removed, changed, or diminished." The last erected ambo in Rome is believed to have been that of St. Pancras, on which the date of A. D. 1249 is visible. Ciampini says the ambo fell into disuse about 1309.

The occasional veiling of the *cleri* from the view of the spectators, implies that the ambo was not of the extended proportion of our cathedral choir. None of the English churches having come down to our times in their original state, we have no direct evidence that the ambo, in its ancient form, existed in British churches.

The sides or enclosures of the ambo are conjectured to have been low, the seats of wood resembling those of chantries in some parish churches, surmounted with lattice-work, and occasionally covered with veils.

Ambrois. See *Bridge.*

Ambulatory. (Lat.) An alley; a gallery; a cloister; a sheltered place for walking in.

Amethyst. A precious stone of a violet colour, much used in cabinets and mosaic work. It was fashioned by the ancients into drinking vessels, and highly prized on account of its supposed virtue of preventing intoxication.

Ammanati, Barthelemo, a Florentine architect and sculptor, was born in 1511, and became the pupil of Sansovino. He completed the palace Pitti at Florence, and designed the court. He is more generally known as an architect, from the bridge called St. Trinita at Florence, and which, from its taste, stability, and lightness, is one of the most estimable modern productions of that kind. He gave a design for the Jesuits' college at Rome, of which the court and front were erected. His greatest work was the Rucellai palace at Rome, which has been greatly admired for the general harmony of its parts, and as exhibiting some fine proportions of the "voids and solids." Ammanati left a book in manuscript on decorative architecture, which has unfortunately been lost. He died in 1592.

Ammiantus. See *Asbestos.*

Ampheres. *In ancient naval architecture.* A small, long, and narrow boat used by the Greeks, propelled by a rower with two oars.

Amphi Cupellum. *In decoration.* A vase with two bottoms, rounding from the bottom to near the middle, where the upper (or inner) bottom was soldered on.

Amphiproræ. *In ancient naval architecture.* Boats with two prows, so made to save time in tacking about, or for use in very narrow channels or canals. "A Peter boat."

Amphiprostylos. (*Amphi-prostulos,* props or columns before both.) A temple which has a portico in both fronts.

This word, says M. Quatremere, describes a particular kind of temple, of which the cella had no external lateral corridors or aisles. The amphiprostyle temple had columns, in front called *pronaos,* those in rear were called *posticum,* by the Romans. It was not, therefore, a building as usually defined, to which a portico or peristyle, at its two ends, was peculiar, for peripteral temples had also two. There was, according to Vitruvius, a gradation in richness, from those in antæ to dipteral and hypæthral temples. Amphiprostyle was the third variety.

Another characteristic of amphiprostyle temples was that of their porticoes, consisting of four columns only. Although Vitruvius does not say so positively, this distinction may be conjectured to be meant, when he states, that the amphiprostyle temple differs only from the prostyle in having two columns at the angles instead of antæ.

It has been remarked, that amphiprostyle temples have never been erected by any people but the Greeks and Romans.

Amphitheatre. (*Amphi-theatron,* Gr. a theatre on both sides; a portico and circus, where people could stand and see from every part.) An edifice formed of two semicircles united, in which all the spectators, ranged on seats in its periphery, saw equally well what was exhibiting in the area left in the centre; thus the Romans also named them "visoria."

In general, amphitheatres usually consisted of a wall, pierced in its circumference by two or more ranges of arcades, having in the inside vaulted passages radiating from the exterior arcades toward the arena, and transverse vaulted corridors, opening a communication to every part of the edifice. The corridors and ranges of seats forming elliptical figures parallel to the outer or exterior wall.

In the middle of the amphitheatre, occasionally, there was an intermediate corridor, which had the same use as those on the basement, serving as a common landing place to all the staircases, an arrangement to be observed in the amphitheatre at Nismes; at other times each staircase had a distinct landing, without any corridor of communication.

The four passages in the direction of the greater and lesser diameter, were sometimes also made wider than the others, and being intersected by the arched passages a communication was preserved with the others. The avenues or entrances through which the emperor and the other great personages of the empire approached their seats, were made in the direction of the lesser diameter. The other two led into the *arena.*

The people entered by the other radiating passages, and ascended the stairs placed in them.

The area within, called *arena,* was of an oval form, around which were vaults, where the wild beasts were kept, that were to be exhibited in the fight. These vaults or huts were called *cavea,* a name sometimes applied to the whole inside of the edifice.

The arena was surrounded by a wall, upon which was the *podium,* a kind of box or pulpit projecting out of the wall; this was adorned with little columns and balusters, and was the place of the senators, as also of the magistrates, who sat there in their curule chairs, accompanied with lictors and other officers; also of the patron who was exhibiting the games, and the Vestal virgins. The podium was 12 or 15 feet high; yet would not the senators have been safe from the attacks of elephants and lions, had their security not been further consulted by lattices and gratings fixed round, from which they could see without danger. It has also been explained, that on the border of the podium were large trunks of trees, so contrived as to turn round whenever any of the animals attempted to jump up, by which mechanism they were thrown down again: even this, however, did not entirely prevent the danger; to remedy which, trenches or canals were dug round for greater security.

Above the podium were benches or ascents, contrived after the same manner as those in theatres. In amphitheatres there were two sorts of them, one higher and broader than the other, and carried quite round the area; the other lower and narrower, carried up from the bottom to the top in right lines, and cutting the several ranges of seats as in the theatres, so that they were more properly staircases. There was, however, this difference between these stairs and those of the theatres, that they did not cut or pass through all the several benches and precinctions, but were carried from the middle of one to the middle of the other; which was without doubt done to prevent the trouble and inconvenience that might arise, had those small steps being carried quite through from the bottom to the top. The benches of Vespasian's amphitheatre (or the Coliseum) were 14 inches high and 30 inches broad; this great breadth was contrived for the greater convenience of egress and regress, as there might be room for those who sat above to set their feet upon that part of the bench nearest to them, without incommoding those who were placed under and before them. The precinctions were benches higher and broader than the rest, to distinguish the several classes of spectators, and also to make the passage in and out easier to the great crowds of people that came to those spectacles. In the Coliseum there are four precinctions visible, reckoning that at the top near the portico; these precinctions were also called *baltei* or belts. The avenues or *vomitaria* were doors at the top of the stairs, to which the audience approached through certain passages. There were also other steps contrived, for the easier approach to particular seats, and likewise for the conveyance of the rain which fell. The *cunei* was the space between the precinctions and staircases, or the benches distinguished into classes. This was a later refinement, for in the more ancient times the audience sat promiscuously. In particular parts of the amphitheatre were pipes for the conveyance of odoriferous liquors, wherewith to perfume the assembly. Veils were also extended over the amphitheatre, to screen the spectators from the heat of the sun; when luxury had increased, these awnings or veils were sometimes made of silk of various colours; and purple ones wrought with gold are mentioned by historians.

The origin of the games which were exhibited in these buildings have been traced to the Etruscans, as well as the invention of the buildings in which they were exhibited. From them the Romans derived their taste for these sanguinary spectacles, and which they introduced among every people they subjected to their dominion: thus we find amphitheatres in every part of the Roman empire; but it has been remarked, that there is no example of a similar institution in nations beyond the pale of their conquests.

But we certainly ought not to look for the amusements of the amphitheatre and its sanguinary games among that people, the inventors and embellishers of the arts, and the softeners of the human character. The Greeks, at once civilized and warlike, tempered the ferocity of war by the pursuits of the arts and philosophy; they granted no honours and opened no gymnasia, but for exercises calculated to soften the spirit and to form the body. As long as they remained free, sanguinary and cruel exhibitions appeared not on their stages, nor did they ever pay men to mangle each other with dexterity or to die with grace. Some authors, however, say, that such spectacles were not unknown in Ionia; Winkelman observes, that if the fact were so, they were not of long duration. Antiochus Epiphanes, king of Syria, was the first who exhibited these ferocious sports in Greece, but he brought gladiators from Rome. These wretched victims of a ferocious enjoyment at first excited pity only and horror in the minds of the Greeks; in process of time their sensibility became weakened, and usage at last rendered these horrid spectacles familiar.

AMPHITHEATRE.

The first mention of the combats of wild beasts in Roman history is about the year of Rome 568; and twenty years afterwards, Livy says, the shows were celebrated with no small pomp, sixty-three panthers, forty bears, besides elephants, were exhibited: from this time they gradually increased. Marcus Scaurus exhibited one hundred and fifty tigers. Pompey exhibited four hundred and ten tigers and five hundred lions, besides elephants. Cæsar, after the civil war, exhibited a still greater number, besides twenty elephants, and five hundred gladiators on foot, and three hundred on horseback. These games being advanced to such a pitch of magnificence, a new kind of edifice became necessary, in which they could be celebrated with more convenience and pleasure. In Cicero's time they were performed either in the theatre or circus. The circus, however, was objectionable on many accounts, besides its danger. At Pompey's games the people were in danger from the elephants, and Cæsar, to avoid the same accident, had trenches dug round the arena.

Pliny gives an account of Curio's amphitheatre in his 36th book. "All the pride of Caligula and Nero," he observes, "in their buildings fell short of the private works of Scaurus. This Scaurus, when he was ædile, caused a wonderful piece of work to be made, exceeding every thing of the kind that had been seen before.—It was a theatre having three galleries, one above the other, wherein were three hundred and sixty columns of marble; (a strange and admirable sight in that city, which in former times could not endure six small pillars of marble hewed out of the quarry in Mount Hymettus, in the house of a most honourable personage, without a great reproach being heaped upon him for it;) the base or nethermost part of the stage was all of marble, the middle of glass, (an extravagant superfluity, never heard of before or since.) As for the uppermost, the boards, planks, and floors were gilded; the columns beneath were 38 feet high; and between these pillars there stood brazen statues and images to the number of three thousand. The theatre itself could accommodate eighty thousand persons to sit at their ease; whereas Pompey's theatre, notwithstanding Rome was more populous in his time, did not contain more than forty thousand spectators. Concerning the other furniture of this theatre, rich hangings of cloth of gold, painted tablets, the most exquisite that could be procured, players' apparel and other stuff necessary for adorning the stage, there was such abundance thereof, that being carried back to his country house at Tusculum, the surplusage, over and above the daintiest part, which he used daily at Rome, did so raise the anger and indignation of his servants for his profusion and monstrous extravagance, that they set his country house on fire, and burnt as much as came to one hundred thousand sesterces. Surely, when I consider and look at the unnatural fancies of these prodigal spirits, my mind is drawn away from my subject, and I am obliged to digress further, and add to this vanity of Scaurus an account of as great folly in another, not in masonry and marble, but in carpentry and timber, of C. Curio, who, in the civil wars, lost his life in the cause of Cæsar. This patrician, desirous of pleasing the people of Rome at the funeral of his father, as the custom then was, but seeing that he could not outdo Scaurus in rich and superfluous furniture, for where could he have such a father-in-law as Sylla?—where have found a mother like Metella, who had her share in all forfeitures and confiscations of the goods of outlawed citizens? And where could he find such another father as M. Scaurus, the principal person of the whole city so long a time together, and who parted stakes with Marius, in squeezing and polling of the provinces, and was the very receptacle and gulf which swallowed all their spoils and pillage? And even Scaurus himself, had he all the wealth of the world, could not have done as he did before, nor make the like theatre again; by reason that his house at Tusculum was burnt, which contained the costly and rare furniture and ornaments collected from all parts of the world, that no man ever after him was able to match the gorgeousness of his theatre. Curio, I say, was thrown upon his invention to devise means to surpass Scaurus in novelty, if he could not equal him in splendour. Curio, therefore, caused two theatres to be built of timber of great size, so that they might be turned so as to make them approach or join to each other, or be removed to a distance, as he should desire, and all by the means of one pivot apiece, that they hung by, which bore the weight of the whole edifice, the balance being so equal, and the whole firm and safe. The contrivance was arranged thus: that in the forenoon he should exhibit scenical representations, when the two theatres should be placed back to back, and that when the audience was satisfied with that sort of show, the theatres should be turned about until the ends fronted each other, (when the fencers and sword-players were to come in, every man in the audience keeping his place and sitting still according to his rank and order,) until, by the meeting of the corners of these theatres, the compass made a fair round *amphitheatre*; and in the middle between them he exhibited to the two auditories, now made one, the spectacles of sword-fighters; so that in truth a man may say that he carried the whole people of Rome round about at his pleasure, and completely bound as to stirring and removing: Of a thing so wonderful it is hard to judge, whether we ought most to admire the device, or its author—the workman, or the designer; but what shall we say to the folly and hardihood of the people of Rome, who trusted to such a dangerous machine, and felt safe in so frail an edifice? Lo! here was seen, the body of that people which commands and rules the whole earth; the conquerors of the world; the disposers of empires and kingdoms at their pleasure; the givers of countries and nations at their will; the vicegerents of the immortal gods under heaven, and representing the image of their power to all mankind; *hanging in the air within a frame at the mercy of a hook, (or pivot,) and rejoicing and ready to clap their hands at their own danger:* what a cheap chance market of men's lives was here! What was the loss at Cannæ to this hazard, that we should complain of Cannæ? How near unto a mischief, which might have happened by the turning of a hand—the universal state and people of Rome supported between heaven and earth, and sitting at the mercy of two pins or hooks! If we well consider this pageant we shall be compelled to confess, that Curio had all the people of Rome to perform a brave skirmish and combat at his father's tomb.—Yet this was not all; for when Curio perceived once that the hooks of his frames were stretched enough, and began to be out of order, he still kept his theatres close together in the form of a perfect amphitheatre; and the very last day of the funeral solemnities, he exhibited on two stages placed in the centre, the wrestlers and other champions; and then suddenly causing the two theatres to be disjoined, and moved in a direction contrary to each other, he exhibited the fencers and sword-players who had won the prizes, and so made an end of the spectacle. See what Curio was able to do, yet he was neither king nor Cæsar."

If this were not the first idea of an amphitheatre, it appears abundantly plain that about this time the want of a place of security began to be felt, in which the hunting of wild beasts, as well as gladiatorial combats, could be witnessed. At the dedication of his forum, Cæsar erected *a hunting theatre* of wood, called an amphitheatre, because of the seats placed around it without scenes.

Pompey's theatre was also made of wood throughout. Augustus being a great admirer of public shows, particularly of the combats of wild beasts, (in one of his exhibitions three thousand five hundred of these animals were killed,) had a design to build an amphitheatre entirely of stone, but it was never carried into execution. However, in his time, Statilius Taurus undertook the affair, thinking that it might be agreeable to the emperor: and he erected, at his own charge, a hunting theatre of stone in the Campus Martius, and dedicated it by the combats of armed men; this, which appears to have been, comparatively, of insignificant dimension, was destroyed by fire in the reign of Nero.

From its small dimensions the public shows were yet exhibited in wooden amphitheatres. Caligula began another amphitheatre, but did not finish it. Nero built a new amphitheatre of wood in the Campus Martius, and finished it within the year: it was well founded, of great size, and firmly supported by large beams. Pliny (lib. xiv. c. 39.) says it had a beam of the larix tree, 120 feet long and 2 broad, which was carried from Rhætia by Tiberius's order, when that emperor caused the bridge at the Naumachia to be rebuilt, and by him shown for a wonder, and preserved long after as a rarity.

After the example of Rome, other cities began to erect amphitheatres. Attilius built one near Fidena, five miles from Rome; but at the celebration of the games the foundation and beams gave way, and twenty-five thousand persons perished.

Another very beautiful amphitheatre, and the largest in Italy, built without the walls of Placentia, was also of wood. Vespasian at last undertook to erect an amphitheatre of stone, of adequate dimensions, which at his death was continued and completed by Titus.

Amphitheatres are also mentioned as having been built at Arezzo, Florence, Fiesole, Adria, and Lucca; one at five miles from Palermo, at Cassano, in Calabria, which is the most entire of any in the kingdom of Naples. At Minturno, which has an arena of 204 feet by 70 feet, the building was 344 feet long, built of brick, and situated near the ancient Lyra; at Benevento was another of stone, nearly of the same size.

There are also some remains of an amphitheatre at Alba, built of Peperino, which had an arena 206 feet long. That at Capua was an extensive edifice, and second only to the Coliseum at Rome, which nevertheless it far exceeded in its exterior ornaments: four orders of columns are there seen. The first exterior circuit was built of stones of great sizes, but the inside was brick. The exterior face exhibited on each pillar in the first range the head of a pagan deity; on the top of each pillar in the second range was a bust of some god; and on the third range an entire statue. These ranges of heads, bustoes, and statues, seem to have comprised the whole pagan mythology and superstition, and afforded one of the noblest prospects in the world; it had an arena about 230 feet long; its entire length was 520 feet.

The amphitheatre of Puteoli is so ruined that there is hardly an ornament to be perceived in it; its arena was about 250 feet long. Remains of another amphitheatre are seen at the foot of Mount Casin, near Varro's country seat, but they present nothing remarkable. There are also other vestiges of a similar edifice at Otricoli. At Catania, the amphitheatre was built of brick and great masses of lava. Agrigentum had also its amphitheatre, so had Syracuse; that of Pæstum was peculiar in its construction.

The amphitheatres of Pola, Nismes, Verona, and Rome, will be afterwards more minutely described.

The Gauls had so great a number of amphitheatres, that they could vie almost with Italy itself in them. There are some remains of one at Frejus, in Provence, of which the arena was 210 feet long. Arles has also some considerable remains of an amphitheatre. The remains of the amphitheatre at Autun, the ancient Bibracti, one of the largest and finest cities in Gaul, gives us a noble idea of that building. The exterior circuit consisted of four orders of architecture, similar to the Coliseum at Rome. It had vomitaria, which led to the stairs, and disposed in a manner similar to those in that building.—Although the precinctum is not, however, observable in the ruins of this amphitheatre, it is by no means probable that so large a building, and having so long a gradation of steps, should have been formed, in this essential particular, differently from any of the others. Vestiges of another building, also supposed to be an amphitheatre, are at Autun.

Amphitheatres were built at Saintes; and of that at Bordeaux, commonly called the Palace of Gallienus, the diameter was 226 feet; at Orange; at Narbonne; at Die, in Dauphiné; at Cahors, the capital of the province of Quercy; at Drenaul sur le Cher; at Toulouse; at Lyons, at Vienne, in Dauphiné; at Paris; at Neri, in the Bourbonnois; at Grand, in Champagne; at Drevant and Bruieres, in Berry; at Valonges, in Normandy; and another about four leagues from Montargis; at Besançon, and at Metz. And it is supposed that Poictiers, Bourges, Rennes, Marseilles, and Treves, also had their amphitheatres; but probably these might have been of wood; that at Perigeaux is of squared stones, having, according to Lipsius, the longest axis of its arena 240 feet, and the transverse axis 160; and at Nice, the amphitheatre had a single range of arcades on the outside, and eight row of seats on the inside. Behind the uppermost row it is conjectured that wooden seats were erected. It had fifty openings in its periphery, and was about 500 feet in circumference.

The amphitheatre at Doue Sur l'Iger, in Poitou, was excavated from the side of a mountain, without any other sub or superstructure, and had twenty-four ranges of seats. The longest axis of the arena was 236 feet, and the shortest about 60 feet.

Nothing is known of the amphitheatre of Tintiniac, except that which is given by Balusius in his Tutelensian history: "There was formerly, about a league from Tule in Tintiniac, a considerable city, some ruins of which yet remain, and among other things the ruins of an amphitheatre, 200 feet long and 150 feet broad, the dens and gaols of which, that now remain, I saw in my youth." The place where the ruins of this amphitheatre are, is called "Les arènes de Tintiniac;" it may from hence be conjectured that the city was anciently called Tintiniac, unless it perhaps be Ratiastum of Ptolemy.

Mention is made of others in Swisserland at the ancient Aventicum Helveticorum, and in the same territory at the ancient Augusta Rauracorum.

The amphitheatre of Hispalis, near Seville, is almost quite ruined; this building was preserved nearly entire until modern times, when the magistrates of Seville finding their city threatened with inundation, ordered it to be demolished, and the materials to be applied in building walls to stem the force of the floods. It resembled that of Nismes, in that the *podium* was very large and spacious. The gates that answered to the podium are very wide and high, and through these it is probable that the magistrates went to their seats. They might also serve for the knights who sat in the first class of seats above the podium. The stairs are carried up from the podium to the uppermost seats of the portico. Another was built at Tarragona; that at Morviedro, the ancient Saguntum, had twenty-six rows of seats cut from the rock, and was 357 feet French in diameter: it appears from an inscription to have been constructed by the inhabitants of that city.

At Smyrna is an amphitheatre built of stone, still in good preservation; it contained 30 or 35 ranges of seats raised on three grand arcades, yet perfectly entire.

An amphitheatre was erected at Sardis, the capital of Lydia, and another at Jerusalem; the Corinthians had also a building of this kind; and there is mention of another at Argos and at Melos; the Hippodrome at Constantinople was a species of amphitheatre.

At Udena, about twenty miles south from Tunis, are the remains of a noble amphitheatre, about 200 yards in circumference, taking its extent from the highest seats in the galleries: it is of an oval shape; the principal entrances into it are one at each end, at the bottom or ground floor of the building, these two entrances have been very broad. There are sixteen other entrances for the spectators, eight on each side, perfectly uniform, and from each entrance there is a staircase to ascend into the galleries; from the bottom or ground floor of the amphitheatre, to the lowest seats in the galleries, is about 30 feet perpendicular, of solid wall, quite smooth, and well put together. The whole has been built with hewn stone generally of a large size, harder than our common English limestone, and of a yellowish colour. Paul Lucas mentions another one at Constantinum in Africa.

At Caerleon, the vestige of antiquity called "Arthur's Round Table," has been supposed to exhibit an example of what has been called a *castrensian amphitheatre.* Such temporary amphitheatres were probably the only ones used by the Romans in distant provinces; since the more pompous edifices of this kind seem to have been confined to Italy, France, Spain, the coast of the Adriatic, and the neighbouring province of Helvetia. Lipsius has given us a list of such of these superb buildings of which there are any remains; but he omits all mention of those of the castrensian kind; and this is the more remarkable, as there is great reason to suppose that the earlier amphitheatres of wood were but the imitations of those attached to the camps, and formed on the sides of hills or vallies. It is well known that the Romans originally stood at games, till luxury introduced sitting; and it is in general remarkable that castrensian amphitheatres preserve no signs of subsellia, or seats; so that the spectators must have stood on the grassy declivity. No vestiges of seats are observable in that at Caerleon, nor in the more perfect one at Dorchester, nor in any other castrensian amphitheatre which can be traced in England, where they certainly have been very numerous. Stukely mentions one at Silchester, and another three miles from Pedruth in Cornwall, — probably also the round entrenchment between Penrith and Shap in Westmoreland is of the same kind.

Of the ancient maritime towns (says Allason) of Istria, Tergeste, Ægida, Parentium, and *Pola*, now known by the names Trieste, Capo d'Istria, Parenzo, and Pola, the latter is the only place distinguished by any remains of antiquity that prove its former importance, among these the most important is its amphitheatre; the town must have enjoyed political consideration and wealth, for this edifice was large enough to contain twenty thousand persons.

The magnificent *Amphitheatre at Pola* is situated without the town, and is one of the most striking, beautiful, and perfect monuments of antiquity; the majesty of its mass, the delightful verdure of the coasts which it crowns, the calm state of the water which approaches its walls, and reflects its august figure, the almost religious veneration which arises in the mind on viewing such splendid remains of grandeur, all conspire to awaken a sensation of pleasing melancholy, which words cannot adequately describe. The walls of the amphitheatre are still entire, and its form is suited to its character, being an ellipsis whose largest diameter is nearly north and south, and measures about 436 feet 6 inches, and 346 feet 2 inches on its shorter axis. In the more perfect parts its height is 97 feet.

The longer axis of the arena measured 222 feet 9 inches, and the shorter 132 feet 4 inches. The heights of the stories are marked on the engraving in English feet and inches. The exterior is rusticated, having two orders of tuscan pilasters, one above the other, the lower being placed upon pedestals. The whole circumference is divided into seventy-two arches, the two at the extremities being higher and wider than the rest. The height is divided into three stories, and, by its particular construction, displays an uncommon lightness and elegance of effect. The space between the contraforti, as Serlio calls them, (though in fact they are two staircases, and so contrived, that those who ascended one of the two flights in each contraforti, could never meet those who descended in the other,) has two orders of voids. On the western sides there are four ranges of voids, one above the other; the first consisting of doors, the next of arches, the third also of arches, and the fourth of windows. This order remains uninterrupted for fifteen arches, when, on account of the rising of the ground on which the edifice is built, the lower range of voids is discontinued on each side; the three remaining tiers are continued on the northern, and so as to include the great arch; and on the southern end, which is next to the city, they include the great arch, and three arches beyond it, at which point the hill again rises, so as to leave only the two upper ranges of arches, and that of windows; and these two ranges of arches form the eastern side. The natural declivity of the hill, at a small distance from the surface, is cut into seats from the area to the top of the second order, for nearly all the eastern half; and the expense of building prisons, corridors, staircases, &c. is thereby saved. On the other side these were built with very thick and massive walls.

The parapet, or finish to the other walls, is singular; and Mr. Woods, who edited the fourth volume of the "Athenian Antiquities," could not find any thing in Stuart's papers to justify the supposition of any mouldings being placed over it. The reason for the singularity is not apparent, and nothing like it occurs in any other amphitheatre. Some indications, the same gentleman thinks, favour the idea that the internal part of the building was of wood.

It is placed on the western declivity of a hill, which, a little below its surface, is solid rock. The architect appears to have availed himself of this situation, to lessen the expense which such an erection must have required had it been placed on level ground. This circumstance has, however, in nowise diminished the grandeur of the principal aspect.

The whole is constructed of Istrian stone, which is of a very superior quality, and, both in appearance and durability, equals the finest marble.

"The style of the building is of the age of Augustus," but the ornamental details are not in the purest taste. They are delineated with great accuracy in the fourth volume of "Stuart's Antiquities of Athens;" and admirable *general views* of this and the other building in Pola are given by Allason, in his "Antiquities of Pola."

In the plate marked "Amphitheatre of Pola," figure 1 is a ground plan of the amphitheatre; and figure 2 a section of the exterior wall.

The Amphitheatre at Verona. Writers are divided in their opinions as to the age of this building; some have imagined it to be of the age of Augustus, and others of Maximian; but Maffei thinks the first date is too early, and the other too late: but of the two, judging from the style of its architecture, it is nearer to the age of Augustus than Maximian; as the whole appears to have been rather the work of the ages wherein the elegancy of the arts were prevalent, than when they were not; besides, the tuscan order in all the stories is an indication of its antiquity. But upon the whole the marquis is induced to believe, that an amphitheatre wholly of stone, and of such architecture, was never built in any colony in Augustus's time, before any such fabric had been erected at Rome to copy from. The silence of Pliny on this occasion is also against its being built in his time. In the time of the emperor Gallienus it was not only built, but began to be in decay; as many of the stones of which it was composed are to be found in the walls of Verona, erected in the time of that emperor; among others many of the key-stones, with the numbers engraven on them, and which were placed over the lower range of arches. In one of the letters of Pliny the younger, who is supposed to have died in the latter part of the reign of the emperor Trajan, it is stated that one Maximus celebrated in Verona a solemn amphitheatrical show, and that a great number of panthers were exhibited on the occasion. Now in the shows of Curio, and also in those of the Fidentines, of Cecinna and Valens, mentioned by Pliny and Tacitus, there were gladiators, but no wild beasts. Judging from this, it were no improbable conjecture that this pile was erected in the age of Nerva or Domitian, or at the latest in the first years of Trajan, and that the builders imitated that of Rome built by Vespasian. It is improbable, however, that a building of this magnitude could have been erected by an emperor, and no notice have been taken of the circumstance by historians; nor could it have been erected by the governor of a province, as has also been supposed, as there were no governors, at that time, in Italy, each city governing itself. It is probable, therefore, that this magnificent pile was built by the citizens, as was also that at Capua: the expense of such amazing works was much lessened by the great number of slaves employed therein, and the abundance of marble which was to be procured in the neighbourhood.

The internal and external form of this edifice is oval; the length of the greatest axis is 450 Veronese feet, and that of the shortest axis 360 feet; the length of the arena is 218 feet 6 inches, and the breadth 129; the exterior circumference is 1290 feet. The height of the exterior façade is about 80 feet, including the 6 feet now under ground; but it is probable that its height, when perfect, was from 110 to120 feet: the steps or seats remaining are forty-five, and twenty-two thousand people can conveniently be accommodated with seats, allowing a foot and a half to each person. In the profile of the walls of this amphitheatre a considerable difference is remarked from those of the Coliseum; the diminution in the thickness of the walls being made towards the inside, as also that of Pola, while in the Coliseum the diminution takes place on the outside. See engraving of section.

The arches of the arena were in number, seventy-two, at Nismes there were only sixty, at Capua eighty. Every arch has its number engraven on it, as is seen in the engraving, which numbers serve to regulate the coming in and going out of a vast multitude of people. There remains a part of the rows of the lower pillars, or pilasters, which from the floor to the impost are

10 feet 8 inches in height, at the bottom they have a pavement about 6 inches high; the capital (or impost, so called because it goes all round) is one foot 8 inches high, and the projection 8 inches. The front of the pilasters 6 feet 3 inches, of which measure the side increases somewhat more than half a foot; the counterfront is not quite an inch in the forepart, so in proportion it is in the other interior parts, all of them being made to retire or contract in proportion as they met towards the point. The counter pilaster, or the flat pillar, runs from the foot of it to the top, and dividing the capital of the pilaster, helps to support the architrave; it is 2 feet 8 inches broad, 19 feet high, and does not project quite an inch, and about 18 inches in the capital. The breadth, or the empty spaces of the arches of the four entrances that remain, is 11 feet 8 inches, though this varies in some other parts; the height of the arch from the pavement to the top is 18 feet: as those voids served in place of so many gates, (which, except on occasion of performing the shows, were kept shut,) on the sides of the pilasters forming the entrance are cavities, or rebates, in which grates, or gates, were placed. The architrave above the capitals is 2 feet high, and the frieze 2 feet 2 inches; the cornice is 20 inches high, and projects about 19 inches. On the second range is a fascia, 15 inches high, having pilasters 12 feet 2 inches high; and their capitals measure 20 inches, and 5 feet 6 inches broad. At their foot is a flattened stone, continued all round, serving as a parapet and fence to those who may have walked in the covered way of that story.—The front or breadth of the pilasters is 5 feet 6 inches; their sides as much: the plain pillar is 2 feet 10 inches broad, projecting 6 inches, and is 21 feet 8 inches; its capital 20 inches. The range of pilasters supporting the arch, beside the flattened stone, are 3 feet 6 inches high, and 8 feet 8 inches broad, and 15 inches deep; the impost projects 6 inches; the width of the opening between the arches 12 feet 3 inches; the thickness of the vault or roof below, and the flooring, was about 2 feet 2 inches; the architrave of this story is 19 inches high, the frieze 21 inches, the cornice 16 inches. In the third story, the three fascia, or bindings, serving as a parapet, are 5 feet high; the front of the pilasters is 8 feet 8 inches, the side 2 feet, the arch 12 feet 8 inches high, the pilasters 8 feet high, the impost 1 foot 2 inches; the plain pillars, placed perpendicularly over the others, are 4 feet 4 inches broad, but they lose themselves from the capitals upwards, the whole wall remaining equal; the breadth of the opening 9 feet 6 inches. The elevation of the arches and the apertures "are so well proportioned, the semicircles are so well turned, the stones hollowed in so masterly a manner, and with such a harmony and fine disposition to the eye, that, whoever beholds it, cannot satiate themselves with beholding its beauty."

The engravings containing the elevation and section of a part of the external wall and profiles of the mouldings, are given, as necessary to the proper understanding the effect of the agreeable *proportions* of this fine building. The *details* are not, however, in a taste to be used as models; the capitals of the upper range of pilasters are remaining; but the shafts either have never been placed under them, or they have originally been intended to form an ornamented *corbel.* From an inspection of the building, this opinion is the most probable.

The engraving of the ground plan, although on a small scale, will explain the general arrangement of the radiating passages, the direction of the seats, and position of the staircases.

The Amphitheatre at Nismes was large enough to contain seventeen thousand persons. It is built in an oval form, and measures about 400 feet in length, and 320 feet broad. It has a circumscribing façade of two stories of arcades; the lower one supported by pilasters and a complete entablature, the upper one by columns, and a similarly perfect entablature; each arcade consisting of sixty arches, of which four principal ones, at the axes of the two diameters, form on the base story the great entrances; the other fifty-six arches form each a portico which runs in the line of the radii to the arena; both above and below, a corridor crossing these porticoes at right angles runs quite round the building. On the base story a second corridor or circular gallery, concentric to the outer one, runs right round the building under the range of seats near to the podium; there is a fourth gallery, which being an entresol placed nearly at an equal distance between the floors of the two under galleries, and at an equal height between the upper and lower gallery, is a general landing-place to the several stairs, and the communication to the *aditus* or *vomitaria.*

Both the entrances by the portal and the portico diminished by a regular decrease of height and breadth, from the entrance at the arch in the façade to the wall of the podium.

In the engravings of this amphitheatre, in which is a restored section of the seats, A marks the base or ground floor, B the second, and C the third; M the section of the lower corridor, which runs entirely round the edifice; P the corridor going round the upper story; N the corridor going round near to the podium, where stairs in the direction of V ascended to the podium. This was lighted by an iron grating or lattice in the wall of the podium next the arena. O, the fourth corridor, an entresol between the two stories, entering at the arch A, and having passed into the corridor M. The spectators ascended by twenty steps, each 9 inches high and 12 broad, into the entresol O; this was lighted by the several passages or vomitaria. Here those spectators of the equestrian rank separated from the people at large, and descended by the stairs R into the greater descent. The plebeians ascended from the entresol O by twenty steps, such as those at Q, in the direction of the line S, into the corridor P of the upper story B; hence they ascended through passages into the benches appropriated to them in the third or upper division.

The people, as we have seen had at their first entrance fifty-six arches by which they entered into the corridors M. Here persons of the senatorial rank separated from the rest, going directly by the portico to the corridor or gallery N; and thence each individual ascended by one of those staircases which his ticket would point out into the podium, where he knew his particular place by his ticket.

The people and knights, each individual knowing by his ticket which of those staircases Q he was to ascend by, would enter into the entresol O.

The arches of the upper story B, which open to the upper gallery P, were originally closed in with a breastwork or parapet, about 3½ feet high. Some of these remain in perfect preservation; the places of those which are gone are supplied with a parapet of modern building. The parapets were of one large flat stone cut into a pannel, on which various designs were carved in bass-relief.

In the present state of the amphitheatre, filled with houses, it looks like a little walled town. The arena has houses on it arranged in streets, and the three galleries, M N O, are converted into numerous miserable dwellings. The houses, stables, shops which are found in the gallery all open on the outside into the town.—Some of the stairs of ascent into the gallery P remain. This gallery is perfect, unencumbered, and can be perambulated as in its original state. The stairs I leading to the vomitaria of the upper division of benches, are those by which one ascends at this day. The half gallery W is also in general clear. In some parts seventeen, in others twelve of the benches, reckoned from the top, are complete and clear of buildings. The next are either broken, or removed, or buried among the buildings. The edifice is formed of immense blocks of stone—in many parts one entire stone runs from arch to arch, and includes not only the impost, but the column, all in one mass, 9 feet long, 7 feet wide, and between 2 and 3 feet high. Some of the stones forming the lintels are 18 feet long.

The precise date of its construction is not known. If built, as supposed, on the model of the Flavian amphitheatre, it cannot date higher than the age of Titus; and there is no period between that and the reign of Adrian, that can be fixed upon, in which such buildings were erected. Adrian built the basilica of Plotina, and the temple of Diana, at Nismes, which a French antiquary thinks was patronage enough for Nismes in one reign, and conjectures that the erection of the amphitheatre might have taken place in the reign of Antoninus, about A. D. 138. That we are totally ignorant of the date of erection of *any* provincial amphitheatre which has endured to our times, is a circumstance as singular as it is extraordinary. From notices of splendid games having been exhibited in this and other amphitheatres, it has been attempted to limit the date of their erection between certain periods; but others think this very absence of all historical notice of the buildings themselves, (from their dimensions, not only the *largest*, but the ornament of the provinces in which they were situated,) cannot be accounted for in any other way, than the buildings from their *antiquity* were so well known, as to preclude mention on the score of novelty. The style of their construction absolutely forbids entertaining the idea, that they were erected after the eras generally assigned to them, even were the means of later times commensurate to the expenses attending the erection of such gigantic fabrics.

The Flavian Amphitheatre occupies an area of nearly six acres, and from its apparent magnitude may be said to be the grandest building in the world. Its plan is somewhat greater than any of the Egyptian pyramids; but on the outside, the Coliseum appears of much larger dimension, as it rises perpendicularly nearly 160 feet, while the pyramids diminish from their base.

Barthelemy from a measurement calculates, that the external wall only of the Coliseum would have cost in his time (1761) a sum equal to £680,000 sterling: labour was then cheaper than it is now; and the external wall may be only a third or a fourth part of the whole work. It was begun by the emperor Vespasian, and finished by his son Titus, about A. D. 79.

Domitian seems to have repaired the amphitheatre; during the government of Macrinus it was greatly injured by lightning. Some inscriptions lead to the supposition that it was also repaired by Theodosius and Valentinian, about the end of the 4th century.

During the persecutions of the early Christians, many of them suffered death on its arena. After the edict of Justinian, which banished all gladiators from the empire, it was neglected; and afterwards, as the triumph of the christian faith over that of the Pagans introduced a more merciful creed, and more refined feeling, the sports of the amphitheatre, and their magnificent arena, fell rapidly into decay, from which they were never again to arise. The Coliseum thus abandoned was seldom mentioned, until about the 12th century. During the feuds of the Guelphs and Ghibellines, it was converted by the Frangepani family into a fortress; and here pope Innocent II. took refuge from the revenge of the triumphant party. In this contest the Frangipani lost possession, and it fell into the hands of the Anibaldi family, who held it until the year A. D. 1311.

Barthelemy (*Mém. de l'Académie des Inscrip.* vol. xxvii.) speaks of a letter in the Vatican, which treats of an agreement between the Colonna and Ursini families in the 14th century, about the *right* of taking Travertine stone from the Coliseum, as well for burning into lime as for building. At that period, however, few building materials were wanted; the fabrics erected in those times of anarchy were only a few brick towers, serving as fortresses, and erected upon the solid masonry of the ancient buildings. Rome being then thinly peopled, the inhabitants poor, having neither arts, commerce, nor a regular government, and divided into factions at war with each other, the dilapidations were for a long time inconsiderable, and confined to the interior of the amphitheatre.

In 1312, a bull feast was exhibited in the Coliseum, in which these families were conspicuous—a circumstance interesting in the history of the building, as it is probable that at that time the stone seats remained, which now are entirely destroyed. In 1332, it again fell into the hands of the government of Rome. The building suffered most after the revival of the arts, when large palaces came to be erected, for which the squared stones of the amphitheatre afforded a good material, and saved the trouble and great part of the expense of quarrying and bringing the stones from the rock twenty miles distant. The nephews of Paul III., Farnese, employed the stones in building their palace, under the direction of the celebrated Michael Angelo: the palace of the Cancellaria, by Bramante, was also built with the Coliseum travertine.

With reference to this dilapidation, it is a favourite old woman's story, on the spot, "that a sufficient quantity of stone was carried away *in one night* to build the Farnese palace." But a sensible antiquary observes, that, although there is no doubt of the fact of this and many other palaces having been built from its ruins, yet, before this could have taken place, it would be necessary to show that all "the carts in Italy, at that moment, were collected at Rome, and employed on this night in this particular business."

The Coliseum was henceforth considered but as an immense quarry; the common people stole, and the grandees obtained, permission to carry off its materials, till the interior was dismantled, and the exterior half stripped of its ornaments. It is difficult to say where this system of depredation, so sacrilegious in the opinion of the antiquary, would have stopped, had not Benedict XIV., a pontiff of great judgment, erected a cross in the centre of the arena, and declared the place sacred, out of respect to the blood of the martyrs, who were butchered there during the persecutions. This declaration, if it had been issued two or three centuries ago, would have preserved the Coliseum entire—it can now only protect its remains, and transmit them in their present state to posterity.

Round the elliptical circumference of the arena, altars or stations of the via crucis are placed, and two or three friars now live in one of the damp cells of the ruin, to officiate and to receive the contributions of the charitable. The external wall consists of the calcareous tufa of Tivoli, called travertine stone; but not more than a part of its circumference remains with the different ranges of orders complete.

The exterior wall remained perfect till the middle of the sixteenth century. A strong and lofty buttress was constructed by Pius VII., to support the extremity of the remaining part. Of the second wall, dividing the two outer corridors, which were carried round the building, about the same quantity is destroyed.—This, as well as the outside wall, being composed of square blocks, has been more dilapidated than some of the other parts. The inner portions of the building, being mostly constructed with brick and tile, offering less temptations, and fewer facilities to being carried off, are still allowed to remain.

Another source of destruction has arisen, from what its founders vainly imagined would have made it more durable—the cramps of iron and lead, used to bind the stones together, have been eagerly sought after and extracted, wherever accessible, throughout the building.

"The perforations," says Salengre, in his "Thesaurus Romanus," "which are numerous between the stones of the piers in the outer wall, appear to have been made for taking out the iron pins by which the stones were connected. The stones were laid without mortar, as in the elliptic amphitheatre at Pola, and other Roman fabrics." Maffei observed similar perforations in the stones of the Roman arch at Susa, and having made a perforation in one of the stones that was entire, he came to an iron pin, run with lead into a cavity in the bed of the lower stone. The pins are sometimes of bronze: these, and the cavities for receiving them, are drawn in Piranesi, tom. iv. tavola 6. Some of these perforations seem also to have been made for the insertion of rafters, to support the roofs of booths and small shops, which may have been erected against it during the middle ages.

The form of the Coliseum is that of an oval, of which the longer axis is 620 feet, and the shorter 513 feet, having its height decorated by four orders of architecture, the doric, ionic, corinthian, and composite, in the series as here named. The columns of the three lower orders project nearly half their diameter, having the intervals between them formed of arches, of which there are eighty in the periphery of each story. The arched openings of the two upper stories had originally statues placed in them, the upper story being finished with pilasters standing over the columns.

The four central openings were the largest; the only one of these now in existence is placed on the north side, and is said to have been the entrance for the emperor from his palace. It is about 16 feet 4 inches in width; the other radiating passages being about 14 feet 6 inches; a portico is conjectured to have been attached to this principal opening, as it is supposed to be indicated on some ancient medals.

The walls enclosing the staircases, and forming the supports to the seats, are carried towards four centres; nineteen on the north and south sides, are directed to points placed on the opposite sides, at A A, in the ground plan, in the fourth corridor, and about 19 feet 8 inches from the back of the podium.

On the east and west ends, fifteen are directed at each end to a point marked B, about 80 feet from the centre of the arena in each direction, excepting the walls of the central openings, which are nearly parallel.

Five corridors, or passages, were originally carried round the building, one side of the fifth corridor being under the podium.

The two outer corridors are composed of open arches; the piers and arches are of travertine stone. These piers are decorated with a pilaster, surmounted with an architrave; from this spring the vaults of the corridors. The vaults are composed of rubble and cement, and appear to have been turned upon boarded (or floored) centres, the marks of the joints of the boards appearing where the thin coat of stucco is destroyed. These corridors were paved with thick travertine stone; this pavement ran round the building on the outside, and was nearly 6 feet broad, and was lower by two steps than the level of the corridor; from the second corridor to the third, the pavement rises rapidly; between these passages are placed the staircases to the first story over the two outer corridors. These staircases are of two kinds: in the one the first ascent is by twelve steps to a broad landing, then by other twelve steps to a similar landing lighted by small openings from the third corridor, then turning, two similar flights conduct to the floor of the range of corridors on the first story; this staircase is shown at number

40. 52. &c. At number 48, in the ground plan, a staircase commences from the third corridor, which rises to the same level as the other with only one broad landing midway. The walls between these staircases are formed by four piers of travertine stone, filled in with piperino stones; but the horizontal joints of the two occasionally do not range. From the third corridor, on the opposite side, a staircase having twenty-five steps conducts to the lower range of vomitories; and occupies the space between the third and fourth corridor; this corridor was paved with travertine. Between these corridors, the walls are faced with tile in regular courses; the outer pier forms a break, and was left of travertine.

The vault of the fourth corridor is quite destroyed; from part of its pavement remaining, it appears to have been laid with white or veined marble about 5 inches thick; the brick wall forming the arena has been likewise cased with various kinds of marble; from this a series of marble steps led to the top of the podium, and it has been suggested that three flights of steps were placed at the centre of the north and south sides, by which the emperor, and the other distinguished persons, ascended to their seats in the podium. The opening in the wall, within the fourth corridor, at 40, 45, and 52, communicated with the passage (formed under the podium) by steps; the three central radiating passages forming the principal north entrance, appear to have been decorated with stucco pannel ornaments, but of clumsy execution. Marble having been used in the walls of this, and in the fourth corridor would indicate that the podium was in the situation shown in the ground plan.

The second story has its circumscribing wall decorated with ionic columns. The corridor on the outside is double, corresponding to that on the ground story, and vaulted in the same manner. The inner vaults do not rise so high as the outer ones, and they are groined; the mezzanine story, or *entresol* over it, ranges in height with the outer series of vaults. The outer corridor is ornamented with pilasters.

From the inner corridor there is an ascent of five steps to the second row of vomitories, and from the inner range of arches, forming the outer corridor, twenty-five steps rise to the third row of vomitories. The approach to the mezzanine story is by twenty-eight steps in the inner corridor. This corridor was paved with very small bricks, laid in the herring-bone fashion; it had also a drain, or trough, with sinkstones running round its inner edge. The outer corridors, and radiating passages, were also paved with these bricks, some of them had a course of travertine stone paving, about 2 feet wide, on one side. The walls were plastered, and painted of a deep red colour; some pedestals remain in the outer arches, which are conjectured to have supported statues. On this story, the staircases are not arranged so regularly as those which are below; the four staircases on the east and west ends being placed differently from the rest.

The mezzanine is lighted by a number of slanting apertures made at the side of the vault, which appear to have been filled with iron gratings. The sides and vaults of this story had a thick coat of plaster, coloured of a deep red; the floor was laid with small bricks, also in the herringbone fashion; and the water carried off by a stone channel. From this story, stairs conducted to the third range of corridors.

Two corridors run round this story, and there are some indications of the outer one having been groined: none of the arches remain. The inner wall is formed of rubble and tiles, and this has been faced with slabs of various coloured marbles. It has doors opening from it, opposite five arches, into as many corresponding passages, having recesses between them towards the inside. The flights of steps rising to the seats above are placed in the inner corridor, and in the outer corridor were the stairs to the mezzanine, formed in a continued line, with a broad landing at half the height. These corridors were paved with small bricks, laid in with those in the lower corridors, and also having a channel running at their outer edges, which communicated by perpendicular tunnels with the horizontal tunnels which carried off the water from those beneath.

The highest seats in this amphitheatre were supposed to have been formed of wood, and they were approached by stairs, ascending against the outer wall. From indications of these, a landing is supposed to have been formed by the meeting of two flights placed in opposite directions, and that from this landing a passage or gallery was continued inwards. On the upper range there were staircases leading to the parapet of the building or platform, for fixing and adjusting the velarium or covering of the amphitheatre.

In the wall enclosing the upper range of seats were two rows of windows; the under row is placed in the dado of the upper range of pilasters, 4 feet 3½ inches in height, and 4 feet 9½ inches in width. The upper row is placed between the pilasters; each window is 6 feet 4 inches wide, and 8 feet 6 inches high; a window is placed between every second pilaster, the under range being placed between the plinths or dadoes of the intermediate space, so that the two rows of windows do not range perpendicularly.

The horizontal openings of the arches of the first range of corridors are 14 feet 6 inches, from the pavement to the soffet of the arch; at their middle point 23 feet 8½ inches, and 16 feet 3 inches to the upper side of the impost mouldings; the pier is 7 feet 1¾ inches wide; the height of the columns of this range, including base and capital, is 27 feet 3 inches, and the entablature to the upper side of the cornice is 6 feet 9 inches high; the columns are 2 feet 9 inches in diameter. These columns are of the doric order.

The dado of the columns of the second range from the upper side of the cornice of the lower story is 6 feet 7 inches high; the height of the columns is 25 feet 5 inches, including base and capital, and their lower diameter 2 feet 10¼ inches, and their entablature and cornice to its upper side 6 feet 6 inches high. The openings of the arches begin from the upper side of the dado; they are 14 feet 7¾ inches wide, and 21 feet 9 inches high; the piers are of the same width as those they stand upon; the height of the pier to their impost moulding is 14 feet 8½ inches. These columns are of the ionic order.

The height of the dado of the

third tier of columns is 6 feet 7¼ inches; the columns, which are of the corinthian order, are 25 feet 8 inches high, base and capital inclusive, and 2 feet 10¾ inches in diameter; the entablature to the upper side of the cornice is 6 feet 6½ inches high; the piers are the same width as those in the story beneath, and 14 feet 3 inches high to the springing of the arches; the openings are 14 feet 7½ inches wide, and 21 feet 5½ inches high.

The dado of the range of pilasters which crowned the building is 7 feet 9½ inches to the top of its cornice, on which was placed a blocking course; from the upper side of cornice of dado to the under side of the entablature of the pilasters is 31 feet; the pilasters are 2 feet 10¾ inches on the face: the entablature of this tier was 7 feet 3½ inches high; the pilasters ranged perpendicularly with the columns of the three under stories.

A series of corbels ran all round the building, on which it is supposed were placed poles or fastenings for the velarium, which covered the building; their position, projection, and use, will be better understood from an inspection of the engraving of the section and part of the elevation of this amphitheatre, than from any verbal description.

In the upper parts of this building particularly, and in general throughout, the dimensions of the pillars, or openings, or mouldings, are by no means uniform. In a building of this enormous size, it would have been extraordinary had the minutiæ accurately corresponded. The proportions stated are those collected from the parts in the best preservation. The style of the mouldings, and their proportions, will be so clearly learnt from the engravings of their sections, that a more detailed account were superfluous. The section of the outer wall will show the thickness of the piers and walls in the intervals between them in the upper stories.

The cornice forming the parapet of the building is perforated, for the purpose, it is conjectured, of inserting the timbers, which passed into the grooves made in the frieze and architrave. The corbels will be observed to be placed immediately beneath these grooves, on which, as has been stated, the masts rested, from which was stretched the awning, to protect the spectators in the amphitheatre from the sun or rain.

The masonry of the lower parts of the building has been finished with greater care than that farther removed from the eye. The piers are composed of huge blocks of stone, many of which extend the whole thickness of the pier, and the joints are secured with metallic cramps; each of the arches is formed of eleven blocks, the key-stone and many of the others extending the whole depth. The voussoirs, or arch-stones, are held together by square projecting tenons and mortises in their *joint-faces:* these are sometimes superseded by metal cramps. The inside of the wall of the upper story, forming the back of the upper range of seats, was faced with tiles, fixed in horizontal courses, behind which were indents or grooves, containing circular pipes of earthenware, for conveying the water from the parapet; probably also that which ran from the velarium or awning.

The building from the level of the pavement on which the bases of the first range of column were placed, and which formed the floor of the first corridor to the top of the parapet of the outer wall, was 157 feet 6 inches high.

The letters on the sections refer to the *details* of the ornaments having the same letters on the accompanying plates: those parts of the sections of the walls shown with a lighter tint, are of piperino or travertine stone; the darker parts show the rubble filling in. In general, it may be remarked that the vaulting under the seats, and in the staircases, was all formed of rough rubble work. For other details of the *construction* of this immense building, see *Colosseum*.

The *podium* was raised about 12 or 15 feet above what is generally considered to be the floor of the arena: on this, as has been already stated at the commencement, were placed the emperor, senators, ambassadors, &c. The throne, or *suggestum*, or seat appropriated to the emperor, was decorated like a pavilion, lined with rich silks, and gorgeously ornamented.

From the podium to the top of the second story, the seats were made of marble, which were occupied by the knights or persons of the equestrian rank, divided into menianæ or precinctions; the lower ones being esteemed the places of the greater honour. Some of these seats were covered with cushions, but most usually they were covered with boards. The marble seats were in the form of wedges 17 inches high, and cut out for steps descending at regular intervals. Above the second story is a wall perforated with doors; above this wall the seats are supposed to have been constructed with wood.

The steps to the seats on the Ionic range are of travertine stone, laid on tiles bedded in rubble; their thickness is about 9½ inches, equal to four courses of tiles, upon which each step rests. The blocks forming the marble seats are 17 inches high, and 3 feet 3½ on their upper side, bevelling on their under side (from a distance of 6 inches from the front or rising) to a thickness of 3¼ inches; they were fastened by being joggled to those both under and above them.

The method in which the velarium was spread, might have been as follows: a cable being placed on the edge of the podium following the curve of the ellipsis, and strong ropes being attached to it, taking the direction of the radiating walls on the plan, and passing through pullies in the poles at the top of the building, which were two hundred and forty in number, and resting on the corbels, the whole might be raised to any height, but would take the inclination of the seats; the awning, or covering, being formed in widths equal to the distance of the masts from each other, was probably made to move on these radiating ropes by rings attached to the edges of each width, and it might be adjusted at pleasure with slighter ropes to move it in either direction by persons stationed on the platform or parapet. The space over the arena was probably left open as well for air as light; marine soldiers were employed to work the machinery.

The material of the velarium, or awning, as has been stated, was sometimes of silk, but it was usually yellow, or iron-red, woollen cloths. Nero once caused a purple velarium to be stretched across the building representing the heavens, with stars of gold thereon, and his own image embroidered in the middle, representing the sun, driving a chariot.

Some Roman antiquaries imagine that the arena was boarded, and that the boards were covered with sand or earth, a conjecture more than probable, as we know that the arena was removable, and capable of admitting of sudden and surprising alterations. Titus himself, who erected it, not content with the usual exhibition of wild beasts, produced the scenery of the countries whence they were brought, and astonished the Romans with a display of rocks and forests. Domitian covered the arena with water, and exhibited marine shows and naval fights; and the suddenness of the changes is often noticed by historians and poets. In succeeding ages they appear to have improved on these exhibitions, and the whole arena suddenly disappeared, and there arose from the chasm, forests, orchards, and wild beasts. These alterations of scene were produced by machines which were called pegmata, which rose and swelled sometimes to a prodigious extent and elevation, and again subsided into a perfect level, or, perhaps sinking still lower, exposed the caverns and subterranean dens of wild beasts, which lay under the arena. Sometimes criminals were raised on these machines, and while engaged with objects calculated to attract the attention, hurled unexpectedly into the dens of wild beasts below and devoured. One of these was in the form of a ship, which, while floating in the amphitheatre, struck the ground as if wrecked, and, opening, let loose some hundreds of wild beasts mixed with aquatic animals, till the water was suddenly let out, the beasts slain, and the ship restored to its original form; exhibitions of flames playing round the machinery, without destroying it, have also been described.

It has been stated that in particular parts of the edifice were pipes for the distribution of perfumes; it was a common practice to sprinkle them in showers; but on certain great occasions they were allowed to flow in great quantities down the steps, or rather seats of the amphitheatre. Seneca informs us that, for this purpose, pipes were conducted from *the centre of the arena* to the summit of the amphitheatre: from this we may infer that *under* the arena were dens of wild beasts, reservoirs of water, sewers to carry it off, spaces to contain the machinery, and cellars for perfumes and the wine with which they were mixed; and also, that the substratum of the arena was movable, and, consequently, had a boarded floor.

This conjecture has been almost confirmed by modern discoveries. When the French had possession of Rome, the arena was excavated, and vaults and passages were discovered under its whole area; openings in the boarded floor, in all probability, communicated with the cells beneath. Unfortunately, before the excavations were completed, the waters accumulated, and, as no precaution had been taken for its drainage by the excavators, it became stagnant; and rendering the air unwholesome, it was found necessary again to throw in the rubbish above the walls; and the arena is now, probably, at its ancient level. A fine view of the walls under the arena, as they appeared at the time the excavation was most complete, is given in a collection of antiquities, edited by Taylor and Cressy. The *details* of this amphitheatre are also given at great length, and with much taste and ability, in this publication.

The drainage of this immense building appears to have had great attention bestowed on it: a large drain was carried round the outside of the building, which received all the water flowing from the interior drains. Another drain, 30 inches wide, is carried round under the second corridor; in this are emptied the perpendicular conduits, and the water from the third corridor; its drain is 17 inches wide and 3 feet deep: these tunnels are lined on their sides with tile. Another drain is placed on the outer side of the third corridor of the same width and construction, laid so as to empty itself into that in the third corridor: other drains extend from these in various directions towards the arena.

Maffei conjectures that there was a movable altar in the arena.

The Coliseum was large enough to contain between seventy and eighty thousand people; that of Verona twenty-two thousand.

Never did human art present to the eye a fabric so well calculated, by its size and form, to surprise and delight. Let the spectator first place himself to the north, and contemplate that side which barbarism and ages have spared, he will behold with admiration its wonderful extent, well-proportioned stories, flying lines, that retire and vanish without break or interruption. Next, let him turn to the south, and examine those stupendous arches which, stripped as they are of their external decorations, still astonish us by their solidity and duration: then let him enter, range through the lofty arcades, and ascending the vaulted seats, consider the vast mass of ruin that surrounds him, insulated walls, immense stones suspended in the air, arches covered with weeds and shrubs, vaults opening upon other ruins; in short, above, below, and around, one vast collection of magnificence and devastation; of grandeur and decay. Yet this stupendous fabric was erected from a *part* only of the materials, and on a portion only of Nero's golden house, which had been demolished by Vespasian as too sumptuous even for a Roman emperor.

Paoli, an Italian author, who has written on the subject of amphitheatres, suggested the opinion, that, as amphitheatrical sports were derived from the Etruscans, amphitheatres had also their origin among that people. That the games were exhibited in narrow vallies, and the audience was ranged on the sides of the surrounding acclivities. When these sports were exhibited in cities, an arena was dug into the level ground, and the earth thrown out was formed into a bank, having seats of turf. The greater the number that was to be accommodated, the deeper the excavation was made; and when the community became rich enough, or the games began to be held in greater esteem, and to be celebrated more frequently, the entire amphitheatre was enclosed by a wall, and the seats were formed of wood and stone. Richborough and Caerleon are examples of the earlier mode, although of unquestionably later date; and

Pæstum of what Paoli considered to be a more improved era, without resting his hypothesis on that particular example being of the Etruscan time.

Paoli's conjecture, without going the whole length of his inference, is exceedingly plausible, and with a greater seeming of consistency than that of his opponent's. It is by no means probable, that Curio's amphitheatre at Rome was the first of its kind, as to a *form* adopted for amphitheatres; or that the Flavian amphitheatre of stone was the model of *all those* in the provinces. In fact, judging from the admirable arrangement of this latter building, it would appear to have been the last, instead of the first of a series of experiments—to have been the *ne plus ultra* of scientific arrangement and construction of a kind of edifice, whose uses and decoration had been long familiar, and deeply studied by Roman architects. Whether these studies were made on the Etruscan types, or what has been called a natural amphitheatre, or on those of a more artificial kind, made by excavation, and forming an agger, or on the wooden building under the first Cæsars, it is now impossible to determine; although all analogies are in favour of the supposition of an imitation of the Etruscan model. See *Baltei, Coliseum, Corridors, Precinctions, Vaults.*

Amphitheatre. A name sometimes given to the area of a modern circus; it is occasionally used, but improperly, for theatre; and a lecture room, with seats in its circumference. See *Theatre.*

Amphitheatre. In landscape gardening. An elevated terrace, having steps descending to a series of terraces, formed on the sloping sides of a hill.

Amphitheti. *In decoration.* A drinking cup of a large size often seen in Greek sculptures.

Amphora. (*Amphiphoreus. Amphoreus.* Gr. A vase with two handles.) An earthen jar with two handles, (from this circumstance also called *diotæ testæ,*) often seen on medals, and among the decorations of tombs, &c.; they taper outwards from the bottom, which ends in a point.

The ancients sometimes built them into the floors of cellars, or grottoes, or surrounded them with a wall, or supported them with frames of wood; and they were the usual receptacles in which were preserved olives, dried grapes, oil, but especially wine. They were generally placed on their narrow end, but some instances have occurred in which they were laid upon their side. Under every circumstance, their use was exceedingly inconvenient; it required considerable care to set them properly; and nothing could be worse adapted for removal; but their use was exclusive and general for many centuries; habit, which rendered their use familiar, superseded reflection. They were sometimes made of enormous size. Caylus describes one 5 feet 6 inches in diameter, and 5 feet high, which was turned both inside and outside, with as much precision and delicacy as if it had only been a few inches in diameter. At the villa Albano, there was an amphora with a capacity of one hundred and fifty gallons.

Amphoræ manufactured at Chios and Samos were esteemed of a better quality than the Italian ones, and were reserved for the preservation of the finer and more precious wines. To prevent the dissipation of the moisture of the fruits or liquids which they held, it was usual to coat them over on the outside with a composition of pitch, tar, grease, and other substances; they were closed by a cork, over which was spread a similar composition. These precautions assisted to preserve fluids in them for an amazing length of time. Petronius mentions some wine which had been kept a hundred years in amphoræ glazed, and coated with chalk and plaster of Paris.

On many of these vessels which have been discovered were inscriptions of the sort of wine that had been put into them, and the date when they were filled; at Rome this was done by inscribing the name of the consul; in the provinces by that of the prætor; on some found at Herculaneum and Pompeii, the prætor's name was written with a red coloured substance, and the quantity of wine which the amphoræ contained was likewise marked on them with colour.

Amphoræ were often appropriated to less dignified purposes; they were placed in alleys and by-streets of Rome, that the citizens "pussent satisfaire aux besoins pressans de la nature." Vespasian laid a tax upon them, and individuals were found to farm these extraordinary sources of the imperial revenue.

Amphora is sometimes used for an Asiatic bath; and was likewise the name of an ancient measure of capacity.

Amphoral. *In decoration.* A crystal vase, shaped like an amphora.

Ampulla. *In decoration.* A vase with a long neck, and having its orifice so small as to let out the liquid by drops; they were used in sacrifices, and were the ornaments of buffets and tables.

Amula. *In decoration.* A vase containing lustral water; a common form in the sculptures on altars and temples; those of bronze are round, or ornamented with laurel leaves, about 22 inches in diameter, occasionally with handles, standing on a foot; marble ones were grooved, or channeled like some shells, 18 inches in diameter, supported on feet fluted like columns.

Amulet. *In decoration.* A figure, or character, to which are attached certain marvellous powers. The Egyptian buildings are covered with ornaments of this nature, and among almost every ancient people, their use may be said to have been general; much of the system of Greek and Roman ornament, and probably every other style of ornament, is but a refined employment of amuletic characters.

Anabathra. (*Anabathra.* Gr. A plank to cross a rivulet; a ladder.) Steps to ascend the postscenium, or pulpitum in Roman theatres: they usually were made of wood, supported by wooden posts, and attached to the walls of the theatre. It is sometimes improperly written *anabathrum.*

Anabathra. Wrought stones formed like steps, and placed on highways to assist riders in mounting or dismounting, before stirrups were invented.

Anaglypha. (*Anaglypho.* Gr I cut slightly.) Something sculptured, cut, or embossed. The word *cameo* is used for anaglypha, where the figures protrude; those stones whose figures are sunk are now called *engraved stones.*

Anaklyntheria. (Gr. Headboard of a bed.) A kind of step to rest the head upon. Venus had a bed, or couch, constructed with four anaklyntheriæ.

Anclabria. The bronze vases reserved for the sacrifices.

Anclabris. A table or small altar on which were set the bronze or other vases for sacrifice, or that part of the offerings intended for the priests. A small portable altar on which offerings of fruit or cakes were laid.

Anchor. *In Greek and Roman architecture.* An ornament shaped like an anchor or arrow-head, used along with the egg ornament, to decorate or enrich mouldings: by some they are thought to have a reference "to the *fire* which vivified the mundane *egg*;" and by others, to be representations of "arrow-heads," alternating with the stones or pieces of metal shaped like "almonds," which the ancients discharged from slings, of which the fillet surrounding the "egg" is a representation.

The "anchor and egg" ornament, as it is called, is peculiar to the ionic and corinthian orders: in two examples of Roman doric, the Trajan and Antonine columns, it is also introduced; but these are exceptions to all other specimens.

Anchor. *In decoration.* Those which are seen on ancient monuments have nearly the same form as modern anchors, only the transverse piece of wood, or the stock, is wanting in all of them. They are generally two-fluked.

Ancona. An Italian city founded by some Syracusans, who abandoned their country during the reign of Dionysius the tyrant, about four hundred years before Christ, was celebrated in the classic ages for a temple to Venus. "In reality, it would be difficult to find a situation more conformable to the temper of the 'queen of smiles and sports,' or better adapted to health and enjoyment than Ancona. Seated on the side of a hill forming a semicircular bay, sheltered by its summit from the exhalations of the south, and covered by a bold promontory from the blasts of the north, open only to the breezes of the west, that wanton on the bosom of the waters which bathe its feet, and surrounded by fields of inexhaustible fertility, Ancona seems formed for the abode of mirth and luxury."

The Romans made this delightful place their principal naval station in the Adriatic, and built a magnificent mole to cover the harbour, and adorned it with a *triumphal arch*; this grand work was completed by Trajan, and to him the triumphal arch is dedicated: it is still entire, though stripped of its metal ornaments. The order is corinthian, and the materials are Parian marble. The form is light, and the whole is esteemed the best, if not the most splendid, or most massive, that remains of similar edifices. It was ornamented with statues, busts, and decorations of bronze; from the first taking of Rome by Alaric, to the revival of the arts, it was certain ruin to an ancient building to be supposed to retain any ornament, or even cramp of metal; not only were the external decorations torn off, but the very nails were pulled out, and stones displaced, and columns overturned, to seek for bronze or iron.

This arch has only one gateway, and is ornamented with four half columns on each front, one at each side of the gateway, and one at each angle. The marble, particularly in the front towards the sea, retains its shining white; the capitals of the pillars have suffered much, and lost the prominent parts of the acanthus; but, on the whole, it is in high preservation. See *Arch of Triumph.*

The greater part of the mole still remains a solid compact, well formed, of huge blocks of stone, bound together by iron, and rising to a considerable height above the level of the sea. Close to it, but much lower, is the modern mole, adorned in like manner with a triumphal arch of the tuscan order, in itself not beautiful; and when compared with the corinthian arch that stands almost immediately over it, extremely cumbersome. The architect was Vanvitelli, a name of considerable repute among architects in the last century. "It is difficult to conceive what motives could have induced him to place an arch of so mixed a composition, and so heavy a form, near to the simple and airy edifice of Trajan, unless it were to display their opposite qualities by the contrast; and of course to degrade and vilify his own production. But all modern architects, not excepting the great names of Michael Angelo, Bramante, and Palladio, have had the fever of innovation, and more than *ten centuries of unsuccessful experiments* have not been sufficient to awaken a *spirit of diffidence,* and to induce them to suspect that, in deviating from the models of antiquity, they have abandoned the rules of symmetry; and that, in erecting edifices on their own *peculiar* plans, they have only transmitted their bad taste in stone and marble to posterity."

Ancon. *In decoration.* A curved drinking-cup or horn. The arm of a chair.

Ancones. "The ornaments depending from the corona of ionic doorways against the antepagments; they were likewise termed prothyrides. The Greek term *agkon,* from which the Latin *ancon* is derived, signifies the arm or bend of the arm. Vitruvius calls the sides of a right-angled triangle subtending the right angle—ancones." The corners or quoins of walls, cross-beams or rafters, trusses or consoles; a sort of brackets and shouldering-pieces, apparently supporting the mouldings placed over them. Corbels; consoles, or ornaments, cut on the key-stones of arches, serving to support busts, or other figures. The two parts or branches of a square which meet in an angle resembling the letter L. The angles or flexures of rivers. A Carthaginian prison or dungeon. See the engraving of "Ancones."

Andrea di Cione Orgagna. A poet, painter, sculptor, and architect, was born at Florence in A. D. 1329: his designs for the additions to the ducal palace at Florence were preferred to those of all the other artists. Michael Angelo was so much pleased with this building, that when applied to by Cosmo of Medici for a design to improve another part of the ducal palace, he advised that the "*loge*" of Andrea should be continued round this portion of it, as he was unable to produce any thing finer. Andrea also revived the ancient practice of joining marble and stones in building with brass cramps instead of using cement or mortar. He died in A. D. 1389

The brother of this architect, who practised as a sculptor, built the tower and gate of St. Pietro Gattolini.

Andrea da Pisa was born at Pisa in A. D. 1270: he was esteemed one of the greatest architects of his time. He designed the castle of Scarperio at the foot of the Apennines; and, traditionally, he is said to have designed the church of St. John, at Pistoia, in 1337: this was a sort of rotunda, well built for the age in which it dates its erection. The greater works of Andrea are at Florence, and which he erected under the government of Walter; he enlarged and fortified the palace of the duke: he surrounded Florence by towers placed at equal distances, and constructed magnificent gates: he designed a fortress for the governor, but which his expulsion from the city prevented being carried into execution. Andrea, however, continued to merit the esteem of the Florentines, who admitted him to the rights of citizenship, and invested him with some honourable offices in its magistracy. It is said he also designed the arsenal at Venice.

He had a pupil, whose works are sometimes confounded with his, called Thomas da Pisa, who built the cemetery in that city, called Campo Santo, and the campanile of the cathedral.

Andron. (Gr. A hall for men. A dining room.) An apartment in Greek houses, appropriated to the men, which was separated from the gynæcea, or that inhabited by the women and children. It was usually placed in the outer or lower part of the house; the gynæcea was in the inner or upper part. A portion of the modern Greek churches allotted to the men.

Andronicus Cyrrhestus. A Greek architect, born at Cerestus, in Macedonia: the date of his birth is unknown: he is said by some to have been the first who studied the winds, and reduced them to eight principal ones. He built a tower at Athens, which is thus noticed by Vitruvius: "Some have chosen to reckon only four winds; the east blowing from the equinoctial sunrise; the south from the noon-day sun; the west from the equinoctial sun-setting; and the north from the polar stars. But those who are more exact, have reckoned eight winds; particularly Andronicus Cyrrhestus, who, on this system, erected an octagon tower of marble at Athens; and on every side of the octagon he wrought a figure in relievo, representing the wind which blows on that side; the top of this tower he finished with a conical marble, on which he placed a brazen triton, holding a wand in his right hand; this triton is so contrived that he turns round with the wind, and always stops when he directly faces it, pointing with his wand over the figure of the wind at that time blowing." See *Clock, Horologium.*

From the style of this building it has been supposed to have been erected about a hundred and fifty-nine years before Christ.

Androuet du Cerceau, who lived towards the end of the sixteenth century, was architect to Henry III. of France. He built the Pont Neuf at Paris, the Hotels de Sully, de Mayenne, and that of the Fermes Général, and designed the fine gallery, built by Henry IV., at the Tuilleries. In the latter part of his life, he emigrated from France; the year, or country, in which he died, is not known. He was the author of several works of great merit; a "Treatise on Perspective;" a "Description of ancient Roman Buildings," and some other pieces.

Angelo and Augustin di Sienna, two brothers, who have left many examples of their fine taste in architecture, at Sienna, Orvietto, and Arezzo; they were the distinguished pupils of Andrea da Pisa, under whom they studied; the year of their deaths is unknown.

Angels. *In mediæval architecture.* Brackets or corbels, with the figures or heads of angels. They are often represented as holding shields, scrolls, pateræ, and playing on musical instruments.

Angle. The opening or mutual inclination of two lines, or two planes meeting in a point, called the vertex, or angular point. They are classed into rectilinear, curvilinear, and mixed, or mixtilinear angles. A rectilinear angle has its sides straight lines. In a curvilinear angle, the sides are curved; and an angle having one side, a right or straight line, and the other a curved line, is called a mixed angle.

Angles are also named from their magnitude, into right and oblique angles; a *right angle* is formed when the sides are perpendicular to each other, or equal to the fourth part of a circle, or ninety degrees, as B A C. *Oblique angles* may be either acute or obtuse, that is greater or less than a right angle; an acute angle, D A B, is less, and an oblique angle, E A B, greater than ninety degrees.

With regard to their situation among themselves, they are called *adjacent* angles, when the leg or side of an angle being produced beyond the vertex, or point of the angle, forms a side of the *adjacent angle,* as GFH and H F I; hence adjacent angles are equal to two right angles, or one hundred and eighty degrees, and are called supplements to each other. *Contiguous angles* have the same vertex, and one leg common to both, as B A D B A C, in which A B is common; the *vertical,* or *opposite angles,* are such as have their sides continuations of each other, as O P and Q R. *Alternate angles* are those made on the opposite portions of a line which cuts, or is divided by, two parallel lines, as V and T, and S and U.

Internal angles are those within any figure made by its sides, as *n o p y*, and *external angles* are those made on the outside of the figure by producing its sides, as *i k l m*. *Angle at the centre* is that whose vertex is at the centre of the curve, as *a b c;* and an *angle at the circumference* is that whose vertex is in the circumference, *d e f*. The sides of an *angle in a segment* meet the extremities of the base, as *r t*, and its vertex *s* is placed any where in the arch *u v*. *Angle in a semicircle,* an angle at the circumference, as *w x y*, standing on the diameter *w y*. *Angle of a segment* is made by the chord of the arc *z s*, with a tangent at its point of contact, as Z S B. *Angle out of the centre* is one whose vertex is not in the centre, as D. *Angle of a semicircle,* the angle made by the diameter with the circumference, as *m* H *a*. *Angle of contact,* that made by a curve line and its tangent.

Angles are farther classed into solid, plane, and spherical. *Plane angles* are those formed by the inclination of two lines in a plane meeting in a point. A *spherical angle* is that formed on the surface of a sphere by the intersection of two great circles, or the inclination of the planes of those circles. *Solid angle* is the mutual inclination of more than two planes, or plane angles meeting in a point, and not contained in the same plane

ANGLES. *In military architecture.* Those formed by the several lines used in fortifying a place, or making it defensible; they are classed into *real* and *imaginary* angles. *Real angles* are those which appear in the construction; *imaginary angles* are those which are only subservient to the processes of delineation or construction. *Angle at the centre,* that formed by two radii drawn from the centre to two adjacent angles, as angle A C B. *Angle of the polygon,* that formed by two sides of the polygon, as D A B. *Angle of the triangle* is half the angle of the polygon, as C A B. *Angle of the bastion,* that formed by the two faces of the bastion, as F A G; this is sometimes called *the flanked angle; diminished angle,* that made by the meeting of the outer side of the polygon with the face A G of the bastion. *Angle of the curtain,* or *angle of the flank,* in the angle G H I, made between the curtain and the flank. *Angle of the shoulder,* or angle of the epaule, A G H, made by the flank and face of the bastion; *angle of the tenaille,* or *exterior flanking angle,* A K B, made by the two rasant lines of defence, or faces of the two bastions produced. *Angle of the counterscarp,* made by the two sides of the counterscarp meeting before middle of curtain. *Angle flanking inward,* made by the flanking line with the curtain. *Angle forming the face* is that composed of one flank and one face; *angle of the moat* is that made before the curtain, where it is intersected. *Re-entering,* or *re-entrant angle,* that whose vertex is turned inward towards the place, as H or I. *Saliant,* or *sortant angle,* that turned outwards, advancing its vertex towards the field, as A or G. *Dead angle,* a re-entering angle which is not flanked or defended.

ANGLE-BAR. *In joinery.* An upright bar at the angles of polygonal windows: a mullion. See *Bay-window.*

ANGLE-BRACE. A piece of timber fixed on two sides of a quadrangular frame, forming the area of the frame into an octagonal opening; the piece of timber B in the engraving, marked "Angle," is the "angle-brace," or *angle-tie*, or *diagonal-tie.*

ANGLE-BRACKET. A bracket placed in the vertex of the angle, and not at right angles with the sides. See *Bracket.*

ANGLE-BEAD. See *Angle-staff.*

ANGLE-CAPITAL. *In Greek architecture.* Those ionic capitals placed on the flank columns of a portico, which have one of their volutes placed horizontally at an angle of a hundred and thirty-five degrees with the plane of the frieze. The engraving of the capital of the temple of Minerva Polias, at Athens, shows this angle, or "horn," as it is sometimes called. It has been stated by some writers that this volute was so placed to correspond to the "*other capitals* upon the columns ranged in the flank as well as in the front;" but this is erroneous, for the angle-capital is found on buildings which had no columns in flank.

ANGLE-CHIMNEY. A chimney placed in the angle, or in a side formed at an angle of an apartment.

ANGLE-MODILLION. *In ancient Roman architecture.* A modillion placed in a direction parallel to a diagonal drawn through the mitre of the cornice.

This mode of placing modillions is never observed, except in buildings erected during the decline of the Roman empire. See *Cornice, Modillion, Order.*

Angle of a wall, or *angle of a building*, the point, or line, where the lines or planes of any two sides of a building meet.

Angle of repose! See *Arch.*

Angle of vision. See *Visual Angle.*

Angle-rafter. *In carpentry.* A piece of timber placed between the inclined sides or planes, or in the line of concourse of the inclined planes forming a hip roof. The angle-rafters are sometimes called *hips*, or hip-rafters. In the engraving marked "Angle," O is the angle-rafter.

Angle-rib. *In carpentry.* A piece of timber, of a curved form, placed between those parts of an arched ceiling, where the planes, if continued, would form an angle, and corresponding with the common ribs, when they are placed in a vertical direction, or to receive or support them when they are in a horizontal direction.

Angle-staff. Angle-bead. Staff-bead. A piece of wood placed vertically, and fixed upon the exterior or saliant angles of apartments, having their horizontal section about three-fourths of a circle, when they are formed with a single bead; when formed with a cluster of beads, the centre bead is made somewhat the greater, and projects so as to form the *angle-bead.* The angle-staff is fixed to the bond timbers, wood-bricks, or plugging, or quartering; the plaster is floated to them; their use is to preserve the angles, which are liable to be broken when made of plaster. In apartments of elegance, the angle-staff is sometimes dispensed with, or is worked to the same face with the face of the wall, showing a rectangle, when the wall is plastered. —In some cases the angle-staff is carried up to the height of 7 feet only; and for the additional height, the aris, or angle of the wall, or break, is of plaster; but, from the shrinking or warping of the wood, it is exceedingly difficult to prevent the joint being seen.

In some old houses the angle-staffs were of larger dimensions than those now in use, and made of oak, and very carefully finished; in many instances they were carved to represent a ribbon or a leaf entwining them, and instead of being painted over with the colour of the walls, as is the practice at present, they were left of the colour of the wood and varnished; sometimes they were gilt or stained black to represent ebony; the effect of the two first methods was very handsome.

Angle-beads, on arches, at the meeting of the spandril and circular planes, are expensive, and unnecessary; it is seldom that they are so truly formed as they ought to be, for ornaments; and in this situation they are nothing more.

Angle-stones. Used by some authors for quoins.

Angle-tie. *In carpentry.* Dragging piece.

Anglo-saxon Architecture. See *Saxon.*

Angular Capital. The modern ionic capital, having the four sides alike, and showing the volute, placed at an angle of one hundred and thirty-five degrees on all the faces.

Annular-mouldings. Generally those having *circular* horizontal sections

Annular-vault. A vault rising from two circular walls; the vault of a circular corridor.

Annulet. Small fillets having

a *circular* horizontal section. The thin fillets, or listels, or bands, which decorate the necks, or under side, of doric capitals.

The number of annulets varies in different capitals; according to Vignola there are three in the doric examples of the theatre of Marcellus; there are four in the capitals of the great temple at Pæstum; and in other cases there are five.

The proportions also of these ornaments vary in different examples; as they form a part of the capital, their profiles will be found, and their peculiarities noticed, under the examples of *capitals* given throughout the work.

List, listel, or *cincture,* are used by Palladio, and *fillet,* by some translators of Vitruvius, as synonymous with *annulet;* a commentator on Scammozzi uses the word *supercilium,* and others *tinea; eye-brow; square and rabbit,* or *rebate.*

Annotinæ. *In ancient naval architecture.* Store or provision vessels.

Ansidonia. An ancient Latin town; of which a part of the cyclopean walls are still remaining. See *Cyclopean Buildings.*

Anta. (*Ante,* Lat. before.) Properly the jambs of doors, or square posts supporting the lintel; pillars forming the entrances of edifices in general.

The Latins called the first row of vines, bordering a vine-plat, antes, and it is probable the word passed from this use into architecture.

Authors are not agreed in their definition of anta. Chambers says antæ are pilasters attached to a wall; Vitruvius calls them parastatæ when insulated; they are not diminished, and in all the Greek examples, their capitals are different from the columns they accompany. Perrault considers antæ, and parastatæ, one and the same thing. Quatremere remarks that the word antæ better expresses pilasters or pillars showing a small part only of their faces; and that parastatæ are pillars which have a projection of a half of their diameter, or show two complete sides of the square. Wilkins defines them, in general terms, "square pilasters, terminating the walls of a temple; the Greeks called the antæ *parastades.*"

There are, therefore, three kinds of antæ, the antæ of porches, or jamb ornaments, the angular antæ, or those showing two faces on the walls of a temple, and the antæ on the *prolonged* walls of the cella of a temple.

"Generally speaking, antæ are only found in temples, applied as wings to the ends of the walls of the pronaos; their use being merely ornamental, and intended to obviate the crude and unfinished appearance which the terminations of these pieces of masonry would otherwise present. As, therefore, they do not belong to the construction, and have no necessary connection with the original type, there is nothing to fix their form, and none of the permanent and essential rules of the order will be violated, whatever may be their composition. The Greeks, therefore, strict and systematic in their method of pursuing the arts, rather chose to treat the antæ as distinct objects, than to confound them with columns, to which they have no relation either in origin or destination. But considered separately, it appears to be admitted, that the Grecian antæ are more beautiful objects than modern pilasters. Much of the beauty of a column consists in its circular form, and the contrast which that offers to the square figures of the abacus and the superstructure; but on this account a pilaster is necessarily inferior to a column, and by aping a resemblance, it only challenges a comparison which must be unfavourable. It is said matters of táste do not admit of dispute; which is so far just, that though one might bring arguments to prove to general satisfaction the absurdity of a particular practice, we know not how its ugliness could be concluded with equal force. To the same author, the pilasters of the orders have always appeared decidedly ugly; and he supposed they are none of them such compositions as an artist would adopt by choice, if there had been no rules and prejudices on the subject. The difficulties attending the use of pilasters are still more sensibly felt in the ionic and corinthian orders than in the doric. In those every architect is aware of the obstacles to be surmounted, and the sacrifices to be made in the lame attempt to accommodate the capitals to a square plan.

The Greeks applied capitals of light, delicate, and even fanciful mouldings to antæ; and, although the differences among these are considerable, they are less than might be expected, where there were no apparent rules to guide or restrain the artist, and do not take away a general resemblance. Except in one instance, that of the Agora, the antæ are undiminished· they are always made *less* in front than the lower diameter of the column, and the lateral face, which does not range or correspond with any column, is frequently not more in width than half the front; and in other cases not even so wide. It is justly observed by sir William Chambers, that pilasters, when undiminished, have in execution an appearance of being larger at top than at bottom. Another architect proposed to obviate this by giving just so much diminution as might counteract the optical deception. It would not be easy to give rules for this slight correction, as it may probably vary with the absolute height of the order; and in this respect experience must be the instructor. The antæ, however, according to the same architect, ought to be of the same width at the top as the architrave which it receives; and he proposed a general rule to make the lower part of the anta a medium between the width of the architrave, and the bottom diameter of the column.

Sir William Chambers, whose taste was decidedly not Grecian, gave the preference to the Roman practice. The Greeks, according to him, employed antæ in their temples to receive the architraves, where they entered upon the walls of the cell. These, though they were in one direction of equal diameter with the columns of the front, were in flank extravagantly thin in proportion to their height, and neither their bases nor capitals bore any resemblance to those of the columns they accompanied. The Roman artists, "disgusted probably with the meagre aspect of these antæ, and the want of accord in their bases and capitals, substituted pilasters in their places, which, being proportioned and decorated in the same manner with columns, are certainly more seemly, and preserve the unity of the composition much better." The pilasters, in Roman architecture, differ only from the column in being square instead of round. Their bases, capitals, and entablatures, have the same parts, with all the same heights and projections as those of columns, and they are distinguished in the same manner by the names of tuscan, doric, ionic, composite, and corinthian. A rule in the use of antæ was that their projection should always be equal to that of whatever mouldings were placed on them.

In a recent beautiful edition of sir William's essay, the editor observes, with great truth, that one of the most objectionable practices of the day, is the servile imitation of the Greek antæ, and that it is quite inconsistent with any regard to the primitive types, from which the Grecian architecture is supposed to have originated; added to this, their application in such very thin laminæ against the walls as in some pseudo-Grecian buildings about London, produces a remarkably silly and sheepish effect.

In fact he might have said, that all buildings having Grecian details, whether the antæ have a "pasteboard or a Roman projection," used as ornaments on the *face* of a wall, (as distinguished from its end,) are absolute *absurdities*; and that antæ, decked out with capitals having the mouldings or ornaments of those peculiar to columns, are beyond all others the most execrable of vandalisms.

In the engravings of the various antique Greek capitals of columns throughout this work, the capital of the anta will be found placed opposite to that of the columns; and the base of the anta also placed opposite the base of the columns. See *Parastades*. *Pilaster*. *Pillar*.

Anta. An insulated square pillar, without base or capital, or any other moulding.

Antaradus. An ancient Phœnician city, of which some remains are still in tolerable preservation near the modern town of Tortosa, in Syria. These are situated to the south of a sandy vale, and consist in some interesting remains of a building, supposed to have been dedicated to the worship of a divinity. A court is cut into the rock with a throne in the middle of it, in which there is a seat on each side; the court is enclosed by the rock on each side, except to the north, where are signs of two entrances; the throne consists of four stones, besides the plain pedestal, which is also cut out of the rock; one forms the back of it, another the covering, and there is one stone on each side; the canopy is surmounted by a cornice similar to those of Egyptian temples. At the two inner corners of the court there seems to have been a small room; the sides of the entrances still remain; "these might relate to the superstition of the place, the throne being probably built for an idol worshipped in this court, or *open* temple, and it is probably one of the greatest and most extraordinary pieces of antiquity that is to be seen." On the other side of the vale, (in which this edifice is placed,) a little more to the east, there is a sort of fosse, cut down in the rock with seven steps on each side, extending near a furlong in length; the steps do not go down to the bottom, and the east end seems to have terminated in a semicircle.

At the west end, the rock is cut away in such a manner that one may suppose there were formerly some apartments there; one part is cut into a square area, from which there is a way into the valley directly opposite to the court or temple; this place probably was a circus. South of the court or temple, the rocks, which rise higher in that part, have been worked like quarries, and sunk down in many places, possibly for reservoirs of water. There are also in different parts, many *walls cut out of the rock*, particularly in one place almost an entire house, the rock being cut away from it all round. There are many niches, doors, and windows in this edifice, and a wall of division along the middle, with a door through it. Half a mile to the west are sepulchral towers:—one of these is in three stones, and another is decorated with lions at the corners; the basement of another tomb is described as being formed of a pedestal 20 feet square, and 9 feet high, having an opening about 3 feet from the ground, by which there is an ascent to the top by three or four steps.

Ante-chamber. An apartment preceded by a vestibule, and from which is approached another room called the inner chamber or cabinet; the chamber that leads to the chief apartment.

The anti-thalamos among the ancients corresponded exactly with the modern ante-chamber; but among the Greeks it was separated from the *thalamos* by a passage called *prostas*. It was the same as that called procaeton by Pliny, or a room before the sleeping chamber. Pliny says his bedroom was joined to his ante-chamber; yet Vitruvius says this was separated from the bedchamber. It is probably on account of the arrangement being an unusual one, that Pliny mentions the circumstance of his bedroom adjoining the ante-chamber.

In modern buildings, ante-chamber is not confined to that only which precedes a bed-chamber, but that which precedes all the rooms of an apartment. In French houses, where the rooms of an apartment enter from an eating room, this forms the ante-chamber. In their mansions, small ante-chambers separate the bedrooms from other rooms; but it is more usual to call the room through which the apartment, or suite of rooms is entered, the ante-chamber.

The use of these rooms, and their decorations, vary in different countries. In Italian palaces the first ante-chambers are of large dimensions, are almost always arched, and occupy in height two stories. In these rooms the chair of state is usually placed. In French palaces the ante-chambers are smaller; the first ante-chamber is the space forming the vestibule and landing-place of the stairs; this is appropriated to the use of the domestics; its ornaments are simple, expensive finishings being here quite out of place. It is generally heated with a stove placed in a niche made in the thickness of the wall, and the warmth is communicated from this into the second ante-chamber; buffets are placed in this room. The second ante-chamber may be made more ornamental; here those persons wait who have occasion to speak with the master; this chamber also serves occasionally as a dining room, or for a "salle d'assemblée;" the style of its decorations is therefore arbitrary. The third variety of ante-chamber is a kind of small saloon, or ante-cabinet, where people of a certain distinction wait on levee or state days until the saloon or cabinet is thrown open; the style of their ornaments may be unobtrusive and simple, but they are sometimes constructed in the most gorgeous mode of decoration.

Ante-chapel. That part of the chapel through which the passage is to the choir or body of the chapel.

Ante-mural. (*ante murus*, Lat. before a wall.) Used as a noun; an outer wall; a boundary wall; a palisade.

Antepagmenta. The three pieces constituting the frame of a doorway; the transverse piece was sometimes called antepagmentum, superius, and supercilium. Pegmata has the same meaning; the moulded architrave of a door.

The Greek words for the antepagmenta were *stathmoi* and *pegmata;* the transverse piece was sometimes distinguished as *'eperthura.*

Antependium. An awning or veil, which was suspended over, and before the altar in mediæval churches.

Anterides. *In ancient architecture.* Buttresses, or counterforts, supporting a wall; archbutants; the Italians call them speroni, or spurs.

Ante-room. The room through which is the passage to a principal apartment.

Antesigma. *In Roman furniture.* A semicircular table-bed, which when joined to another formed a round table.

Ante-temple. What is now called the nave of a church.

Anthemius. An architect of the sixth century, was born at Lydia, in Asia Minor; he was selected by the emperor Justinian, along with Isodorus, to build the celebrated church of St. Sophia, at Constantinople. A vast building had been constructed on the spot by Constantine, but its roof having been formed of wood it was several times destroyed by fire, and as often repaired by succeeding emperors, particularly by Theodosius; Justinian undertook to erect a pile worthy of the seat of empire, and of materials which would ensure its stability. Justinian having lived to finish it, is reported to have said in a transport of joy, "I have surpassed thee, Solomon." Anthemius was a machinist and sculptor, as well as an architect, and there still exists a collection of machines which is ascribed to him. "He was celebrated for contrivances to imitate the appearances and effects of thunder, lightning, and earthquakes. His biographers relate an anecdote of the orator Zeno having offered some slight to Anthemius; the latter, in revenge, constructed an apparatus, which was placed near the walls of Zeno's house, which emitted sounds so like those preceding some earthquake, that the orator in his fear abandoned his habitation. Anthemius on this occasion is said to have produced the effect by cauldrons of boiling water arranged in a peculiar manner."

Antics. *In architecture.* Fancies having no foundation in nature, as sphinxs, centaurs, syrens, representations of different sorts of flowers growing on the same stem; grotesque ornaments of all kinds, as lions, and pards, with acanthus' tails, "or any other tails but their own proper ones;" human forms with similar ridiculous appendages.

Ornaments, although strictly natural, in an unnatural situation; as, caryatidæ of all kinds.

"Antics, in construction, an absurd and ostentatious display of art, such as the leaning tower of Pisa, built by design to appear as if falling; an immense tower, or other weight, supported on slender pillars:—in this view, the whole system of pointed, or gothic architecture; all buildings erected in England, after the gothic fashion, posterior to the revival of Grecian art by Stuart and Revett, except as additions to ancient buildings, in that style."

Antics, in plans, sacrificing symmetry, and convenience, to obtain some particular horizontal outline, as the palace of the Escurial, built in imitation of the gridiron on which St. Bartholomew suffered martyrdom; and antics in decoration, a cast iron bridge, made like an immense "brobdignag gridiron," on which future saints may be roasted.

The villa Palagonia, in Sicily, is an antic, from the entrance gate to the chimney top.

"This extraordinary place is approached through a huge gate, on the plinth of which are fixed six colossal white-washed statues of hussards and halberdiers, to dispute the entrance of an avenue three hundred yards long, not of cypresses, elms, or orange-trees, but of monsters.

"On each hand is a parapet wall loaded with more horrible figures than ever were raised by Armida, and all the enchanters of Ariosto. Busts of punchinellos and harlequins, with snakes twisted round them, the heads of dwarfs with huge periwigs, of asses and horses with laced cravats and ruffs, compose the lower range of this gallery, and at intervals of ten yards are clustered pillars, supporting curious groups of figures:—some are musicians, others pigmies, opera heroes, old women grinning, lions, and other beasts, seated at tables, with napkins under their chins, eating oysters; princesses with feathers and furbelows, ostriches in hoops, and cats in boots. In short, more unaccountable mixtures of company, and unnatural representations of creatures, than travellers had patience to note, or memory to record. They are luckily all made of so soft and perishable a stone, that we need be under no apprehension of this collection passing to posterity as a monument of the taste of the eighteenth century, many enormous noses, and preposterous limbs, have already crumbled to dust. The stone-cutters, that made those figures, though they could barely trace out a resemblance of the human form, have shown great dexterity in carving curls, foliage, and flounces, out of such coarse materials.

"This avenue of Pandemonium, leads to a circular court before the house, crowded with stone and marble beings, not to be found in any books of zoology. Men, monsters, and animals, line the battlements of the mansion, and stand so thick, and in such menacing attitudes, that it would not be safe to approach it in a windy day. The walls are cased with basso-relievoes, masks, medallions, scriptural subjects, heathen gods, emperors, and posture-masters; some of the sculpture is in a good style copied from the antique; but the greatest part consists of such figures as we meet with in Dutch fairs, representing the seasons and the elements. Within doors the same sort of company presents itself; but the proprietor has for some years past abandoned this wonderful abode, and many of its beauties feel the wonderful effects of his absence. The ceilings of the rooms are of looking-glass, the walls lined with china, and with delf baubles. Monkies hold up the curtains, horses mount guard, and devils wait at the foot of the stairs; the ball room remains imperfect, though intended for the *chef-d'œuvre*; round it runs a marble bench, which, upon examination, is found to contain a great number of night tables."

When the prince of this palace of folly, who squandered £40,000 in these creations, was asked in what part of the world the originals of his figures and ornaments were to be met with, he answered in Egypt, where, Diodorus Siculus tells us, the rays of the sun act so powerfully on the *slime* left by the Nile, that it engenders all sorts of *uncouth and unknown* forms. A learned traveller observes, that from "referring to Egypt for his types, it is quite clear the prince never had visited England."

This favoured island yields to no other country whatever in the number and importance of her architectural novelties. The entire limits of our dictionary, we believe, would hardly suffice for a bare enumeration of a tithe of the national trophies in this way. The selection of the following example is made more with reference to the authority of authors on architecture, than from our own opinion; indeed it were great presumption in any individual to place his opinion against that of so numerous, so sagacious, and so scientific, a body, as that which has adopted Mr. Emlyn's order as its own. "My first notion of the new order," says Mr. Emlyn, a *civil* engineer, and one of the most influential and distinguished of that profession, "was formed in his Majesty's park and forest at Windsor. On considering the beauty of the single trunks of trees, which are believed to have been the origin of the Grecian columns, my speculations were most agreeably diverted by the frequent views of the *twin trees*, which nature has distinguished by the most pleasing and regular variety; and recollecting some lines of Mr. Ware, in which he has observed, 'that there was no reason to say that another order should not be invented, not as being wanted, but as it would farther vary the system, and was worthy to be attempted,' it appeared to him that nature had pointed out another kind of column, deserving of imitation, hitherto unnoticed, and which might produce *a sixth order* of architecture," or the "CIVIL ENGINEER ORDER," with *new* proportions. "From hence," continues this scientific engineer, "I began to form such as appeared to me the most agreeable to nature, and most suitable to my design. From my different observations and trials, the *twin* column, and entablature to it, (which appeared to be of equal strength with the columns of the corinthian order of the same height,) from its form and lightness, I conceived might be adopted with advantage in building, as it appeared sufficiently solid and durable, and I trust it will not be thought to carry with it any gothic indecorum.

"As Windsor," continues this accomplished civil engineer, "had the honour of an *order* established there, *the most noble order of St. George*, and as its forest had given me the first idea of the proposed column, I was ambitious to wish to complete an order in architecture in conformity to the hints received, and the nature of that honourable institution. As the doric order was composed on the system of manly figure and strength of robust and Herculean proportions; the ionic on the model of the easy, delicate, and simple graces of female beauty, to which the corinthian, on a similar design, adapted a symmetry of more artificial and complicated elegance; this column is composed on the plan of representing the particular character of our ancient English chivalry in its most illustrious order, which, as a distinction of peculiar eminence, has not become obsolete, but is still considered as an ornament that adds splendour to the highest rank, and an honour suitable to the most eminent desert. Its knights and companions, united by the nearest tie of equal and honourable confraternity, deriving from the same source their conjoint dignity, the basis of which is the sovereign of the garter.

"In pursuance of this double idea, the conformity to the natural object which first occasioned the design, and the allusion to that order of knighthood, the columns are imitations of nature, often taken from the *twin trees*, as the capitals are from the *plumage of the caps of the knights*, with the ionic volutes interwoven and bound together in the front, with the *star of the order* between them, and the *supporters* of the arms of England issuing out of the foliage of the volute; and in the profile of the capital is a 'lion's snout,' rising out of a *rose*. In the *cleft* between the *two* stems, where they divide from the lower trunk, there is an ornament introduced, instead of the protuberant bark, which sometimes naturally forms a festoon, viz. the *knight's* shield and armour, with the *skin of a wolf* hanging down on each side, and bending down the twigs of the tree, all which together cap the centre of the trunk on both sides: although this animal was exterminated from our island before the institution of the order designed to be the subject of the leading ornaments of the column, it will not appear to be unsuitably introduced, as pointing to the love of exercise and public utility combined with their diversions, which distinguished the ancestors of the knights. The upper member of the base is enriched with the *claws of that animal* rising out among the leaves. The fluting of the trunk is *cabled*, and the cables hollow, and fitted with the English arrow, the feathered end rising out of each of them. The ornament of the frieze, over the columns, is a plume of the ostrich feathers, a distinguishing mark of honour peculiar to the prince of Wales; the bottom of them comes through the upper member of the architrave, and is mixed with *acorns*, and tied with a *ribbon*. In the metopes are placed the *great George* and *collar*, and in a continued frieze, other *symbolical* ornaments, as naval and military trophies; the modillions are enriched on the sides with *oak leaves* and *acorns*, and on the bottom with *mosaic* work. The pannels in the soffet of the corona, are filled with helmets, stars, and roses. As a *finish* to the column, I have crowned it with the *sovereign* of the order of St. George."

"As modern architects," says another *civil* engineer of great eminence, "imitate, without reason or an' appeal to experiment, the columns left by Greeks, who constructed them some thousands of years ago, or by Romans, who lived nearly at the same time, and who were unacquainted with the 'refinements of modern analysis;' it is no wonder that their productions are not 'scientific,' and that the quantity of materials they contain far exceed the values indicated by the latest 'formula.' In the 'civil engineer order,' this defect has been obviated, by making the entire height of the order equal to twenty-five diameters; the pedestal is a fourth of the height; the height of the column is *seventeen diameters and two fifths*; and the height of the entablature is three diameters and four tenths: thus forming a composition admirably adapted to every useful and ornamental purpose, and peculiarly fit for being formed of *cast-iron*; that wonderful material, whose use seems destined shortly to supersede the stone and marble absurdities of the antique, and thus to form a new era in the history of 'scientific construction.'"

Anti-cabinet. *In French houses.* A large apartment placed between the hall and the cabinet; usually called the "salle d'assemblée."

Anti-cour. A French word, occasionally used by English authors. The approach to the principal court of a house; they sometimes serve as a communication with the cellars, kitchen, stables, &c.

Anticum. (Lat.) A porch to a south door, as a distinction from porticum, or porch to a north door. The space between the front columns of a portico and the wall of the cella, was also called *anticum*; the word is sometimes used improperly for anta.

Antimachides. A Greek architect, who, along with Calleschros and Perinos, began the famous temple of Jupiter Olympus at Athens, by the command of Pisistratus, and which was completed by Antiochus three hundred years afterwards.

Antinopolis, or *Antinæ.* A city of Egypt, built by Adrian in honour of Antinous his favourite, who was drowned here when he accompanied that emperor to Egypt. Adrian instituted games and divine honours to his memory.

The town was divided by two grand streets 45 feet wide, and about a mile and a quarter long; these streets, forming a kind of cross, had others, but smaller streets, branching from them, but of equal lengths, and in the same lines. Along the sides of these two principal streets was a continued gallery 5 or 6 feet wide, supported by stone columns of beautiful workmanship; so that this city was a grand peristyle, where the passenger was protected from the heat of the sun, or the coldness of the atmosphere; many of these fallen columns are found in several parts of the site, and some remains of arcades. Near the city is a place eight hundred paces long by seventy wide, which was probably a circus where Adrian celebrated sacred games to the memory of Antinous; this is surrounded by immense blocks of stone, forming eight ranges of seats rising one above the other. The city had four grand gates, those on the south and west are still remaining; the south gate is a kind of triumphal arch with three grand arched openings, the middle one 22 feet (Fr.) wide, and 40 feet high; the side arcades 24 feet high, and about 11 feet wide. The entire gate is about 66 feet high, and from 15 to 20 feet thick; its two façades are adorned with eight corinthian pilasters, fluted from about the middle of their height to the base: the volutes of the angle capitals are so great that the Arabs call the erection the father of horns. Opposite these pilasters, at a distance of five or six paces, are eight corinthian columns of white marble; their shafts are composed of five equal pieces, fluted from the middle to the base, 40 feet (Fr.) high, and 14 or 15 feet in circumference; the capitals are formed of two stones each, 7½ feet in diameter. The western gate is nearly as perfect as the southern gate, but in a different style. It has also three large arched passages; the middle one measured 16 feet wide, and 20 feet high, the two side arches being about half the width and height with the others. There is also formed above the gates, three grand, large, square openings, which form a kind of platform, that in the middle being larger than the two others; two stairs, each having fifty steps, are formed in the walls, and conduct to these openings; this gate is about 50 feet in front, 35 feet in height, and 45 feet deep. The remains of other buildings may also be traced; among these are some vestiges of a palace, which appears to have been of great extent.

Antioch. An ancient Syrian city, founded by Seleucus Nicator, and named by him after his father Antiochus. It was one of the most considerable of the cities of the east, and was the residence of the Macedonian kings for many ages, as it became afterwards that of the Roman governors of the province; it was called, by way of eminence, the queen of eastern cities.

The walls of the ancient city are entire in many parts, and such is the solidity of their construction, that the dilapidations have been caused mainly by earthquakes. The ancient city being situated on the summit and north side of two hills, and on the plain which is to the north of them, the walls are built along the heights of the hills, and a deep fosse renders the south approach (where there is no descent,) very difficult. These hills are divided by a deep narrow bed of a mountain torrent, across which is built a wall at least 60 feet high; about halfway up on each side of the wall there is a walk from the road on the hills; the eastern passage seems to have served for an aqueduct: this wall is a most extraordinary building, by which the two hills are joined above the bed of the torrent, and constructed with extraordinary skill. On the west side of one of the hills the wall is built with stone, with beautiful square towers at equal distances, which consist of several stories; this is thought to be the very wall built by Seleucus, yet there is not the least breach in it, or sign of any. It had no battlements, but a walk all round it on the top, and where there was any ascent the *top of the wall was made in steps*, so that they could go all round the city on the walls with the greatest ease; and it is also probable that there were such steps on the walls, which were built up the very steep precipices, where now it is in ruins; some ruins of Roman reparations are seen on the south side of the city. The towers are about seventy paces apart.

The walls and towers are about 40 feet high, and 6 or 7 feet thick, formed of stone and lime, with layers of brick, and crusted with fine cut granite flags, which gradually diminish in size as they approach the top; the towers are more lofty than the walls; of a quadrangular form, divided into three floors, one upon the ground and two above, the latter being filled with loopholes, and sometimes small embrasures.

There are few remains in the city of any ancient buildings; on the summit of one of the hills are the remains of a citadel, with *semicircular* turrets in front. Vaults are constructed under it, which are conjectured to have been reservoirs; at the north-east corner are also some vestiges of baths; in addition to these, the citadel was supplied by another basin between the citadel and principal summit, fifty-three paces in diameter. Near the foot of the hill are the remains of a large building of brick, traditionally said to have been the palace of the emperors, from the style, of the fourth or fifth century.

The aqueducts are the principal remains of antiquity at Antioch; the water was derived from a hill distant about four or five miles, and to which numerous lesser streams were conducted in channels. The water was conveyed from this in underground channels into a little valley, thence it was conducted on arches which still remain. The stream was conducted along the sides of the hills as often as practicable, and carried over the beds of other waters by arches. At a certain part of the hill were small arched chambers, or conduits, whence water was drawn for the convenience of the various parts of the city; in one part a channel is cut through the rock 2 feet wide, and 4 or 5 feet high, worked archways at top; there was a lower aqueduct built by the Syrian kings, before this one was begun, which is conjectured to have been the work of the Romans. In some places the lower aqueduct had three stories of arches, the uppermost joining the channels on the opposite sides of the hills. Many excavations are also seen in the mountain, conjectured to be places for burying the dead. There are remains of three or four ancient churches in Antioch; one of them is called the patriarchal church, from St. Peter, or St. Paul having preached, or lived, there.

The present city of Antioch is ill built, the houses low, with only one story above ground; the roofs are almost all flat, made of light rafters laid from one wall to another, and covered with *thin* tiles, which seem to be contrivances to make their houses as light as possible, that they may not sink into the bad foundation on which they are built, or if they should chance to be thrown down by the concussions of an earthquake, that the inhabitants might not be crushed by the weight of the roof; the walls are neatly built of stone; the houses are two stories high, have a square in the centre, and the rooms are lighted by small arched windows.

Antique. A word* used by architects to distinguish every work of art produced by Greek or Roman artists, between the age of Alexander the Great, and that of the emperor Phocas, about the beginning of the seventh century, when Italy was overrun by the Goths and Vandals. The word is technically synonymous with beautiful, most excellent, perfect. The phrases, " it is an antique," " it is not an antique;" " it is seen in the antique;" express an admiration " très raisonnable, quoique souvent peu raisonnée," of the works of the Greeks and Romans; and when applied to modern productions these phrases express the degree of resemblance between the style and taste of the modern work, and those ancient remains, which are considered to be the models which ought, or were intended, to have been imitated.

Works of art dating after the sixth century are *ancient*, but not *antique*: those also are excluded from the antique whose age may be anterior to that of Alexander. The Egyptian buildings, although of higher antiquity, and of considerable pretensions to merit, are not classed among antiques in the ordinary acceptation of the term; neither are the remains of art, at any period of any people except Greeks or Romans, called antiques, such as Persian, Indian, or Druidical productions.

Whatever causes, arising from education or climate, may have produced the fine perception of beautiful forms which shines in Greek productions, it is this which alone gives them their claim to our consideration. The knowledge of the antique is but another name for the study of nature, with this advantage, that in these works we have the fine parts of nature, or those most worthy of imitation, alone, presented to our observation. *Antique remains* are, therefore, to be considered as so many *experiments made by men eminently gifted with sagacity and penetration, on forms best calculated to please the eye, and satisfy the understanding*. In no Greek building has the one been followed to the exclusion of the other.

The study of the antique on this account is considered to be the only path by which an architect can aspire to distinction. In this study, the first and greatest concern is, the choice, or selection of models which are proposed for imitation, and the second, the judgment to direct this imitation.

In the ages, for instance, to which the *antique* is limited, it is natural to suppose, independently of many examples which will occur to every one, that the style and taste were by no means equal; the arts of the antique time, like all other things, had their periods of increase, of maturity, and decline. It is necessary, therefore, to distinguish between works of these eras, and to aim rather at the excellence of the mature period, than to imitate that which bears the impress of infancy or old age. The period of the government of Pericles, is the era of the exquisite antique among the Greeks; and that of the reign of Augustus among the Romans. Nothing, again, is more common in modern buildings, than to observe *details* in the *finest antique* taste, decorating compositions, which, as wholes, are absolute vandals. No architect would find it difficult to erect a building with all the fritter and complexity of a gothic chapel, in which every moulding, and ornament, should be drawn from the most exquisite Greek buildings; yet what taste, however depraved, would call the monster antique. An *entire antique building* may be imitated with all the fine feeling of a Greek architect, and yet be applied to a purpose, or placed in a situation so absurdly, as to rank no higher than a boyish barbarism. The temple of Pandrossus, for instance, made a porch to a cemetery with the modern improvement of making the door in the dado, and forming its lintel of a Greek coffin, is on a par with Inigo Jones's placing a classic screen in Winchester cathedral.

The imitation of antique details, or of entire buildings, do not therefore give an architect a claim to a classic taste. A composition may be in the finest and purest antique taste, and yet not possess a single ornament or moulding which could be referred to any existing Greek example, in fact be destitute of ornamental details of every kind. Many of Poussin's groups are of this character; but how many compositions are there by other artists, where every *detail* can be traced as drawn from the "purest well of Athens undefiled;" yet are no nearer the antique than any of the works of William of Wickham.

ANTIQUITIES. Technically, the remains of ancient buildings, or works of art, considered as in classes; or as peculiar to, or connected with, a place or district.

ANTIQUARY. A person devoted to the study of the remains of former times generally; a collector, or expounder of ancient objects. Every architect is, or ought to be, an antiquary by profession, as far as regards a familiarity with that division of antiquities, relating to the remains of ancient art, for it is only by a persevering and discriminating study of these, that he can hope to form his taste, and direct his practice.

ANTIQUARIUM. (Lat.) A room or cabinet where ancient books and vases were kept.

ANTIQUO-MODERN. In some dictionaries, "the pointed style of architecture generally understood by the word gothic."

ANTIQUUM. So named by Vitruvius because it was in his time the earliest known method of building; antiquaries are not agreed whether it means small stones thrown into cement, or large stones, among which smaller were inserted.

ANTISTATES. A Greek architect, one of the colleagues of Antimachides in erecting the temple of Jupiter Olympus, at Athens; "the design of this building was grand and magnificent, inspiring reverence, and exciting admiration." The death of Pisistratus put an end to the work, and it was ages afterwards before it was finished. Many sovereigns coveted the honour to complete and embellish it; among others Perseus, king of Macedon, and Antiochus Epiphanes, four hundred years after Pisistratus, employed Cossutius, a Roman architect, to finish the body of the temple, and the portico. This monument of the piety of these princes was considered one of the four most famous Greek marble temples, the three others being that of Diana, at Ephesus, the temple of Apollo, at Miletus, and Ceres, at Eleusis. The temple of Jupiter was depteral, and octostyle: in it were placed the statues of the Athenian colonies. Two orders of columns, one placed over the other, and ranged at a certain distance from the walls of the cella, surrounded the interior; the middle was open. The temple was completed by Adrian.

ANTONINE COLUMN. See *Column*.

ANTONIUS. A Roman nobleman well skilled in architecture. He constructed many buildings at Epidaurus, in the Peloponnesus; the greatest of which was a temple dedicated to all the gods; he erected others consecrated to Apollo Esculapius.

APARTMENT. (*Partimentum*; Lat. from *partiri*, to divide; or from *a parte mansionis*, a part of the building.) A space enclosed by walls and ceiling, as distinguished from court, or area. A set, or suite of rooms necessary for the complete habitation either of an individual or a family. Apartments; chambers.

An apartment ought to consist of a hall, ante-chamber, chamber, closet, cabinet, and wardrobe, with the usual offices for the accommodation of attendants, and preparation of food. The houses of the French and Italians are generally arranged so that many families live under the same roof, each habitation is approached by a stair common to the whole, and generally all the rooms of an apartment are placed on the same floor. In Scotland this arrangement is also still very general, and may probably have been derived from the French practice. In England the arrangement of the houses being totally different from those of Italy or France, the word is nearly obsolete in this sense, and is never used in the singular, except as synonymous with *a room*.

An *apartment* in French building is divided into "appartement de parade," and "appartement privé;" the rooms of the "appartement de parade" are of ample dimensions, and decorated with magnificence, for the "reception of distinguished visitors, and for holiday merry-makings." The vestibules, ante-chambers, saloons, galleries, chambers, and cabinets, which compose an "appartement de parade," should be ranged "en enfilade," and proper care be had to dispose their openings, so as to allow the decorations of the courts and gardens to be viewed from points where they may add variety or richness to the interior arrangements.

As the dimensions of the "appartement de parade," and its sumptuous decorations, do not always accord with domestic convenience, an "appartement privé," or the "petit appartement," is usually attached to the state rooms.

The "appartement privé" is farther divided into "l'appartement de la dame," and that "du mari;" the divisions communicate with each other.

"The lady's apartment is ornamented with a light and tasteful elegance, that of the gentleman with more gravity and pomp, the one contains handsome boudoirs, cabinets for dressing, and a bathing room; the other has cabinets for study, a library, cabinets for collections in philosophy or the fine arts, and a billiard room. Each of the divisions is preceded by a distinct vestibule, entrance-hall, and a 'salle de réception;' a bedroom with its ante-chamber, and a 'lieu à l'Anglaise,' with chambers for the valet and femme de chambre; the bedrooms adjoin each other; the eating room and conversation room should be common to the two apartments, but each division of the 'appartement privé' should have separate approaches and staircases." See *Decoration*. *Room*.

Aphractæ. (*Aphraktos*, Gr. uncovered.) *In ancient naval architecture.* Long vessels with one range of oars without decks; but sometimes with beaks or rostra. They were distinguished from cataphractæ, which were close-decked vessels; and had planks towards the poop and prow for fighting from.

Aperture. (*Apertura*, Lat. a small open passage.) An opening through a wall, or roof, or floor, of any form, as doors, windows, chimnies, drains.

"Apertions," says sir Henry Wotton, "are inlets for men and light; they should be as few in number, and as moderate in dimensions, as may possibly consist with other due respects, for in a word all openings are weaknesses. They should not approach too near the angles of the walls; for it were indeed a most essential solecism to weaken that part which must strengthen all the rest."

Apiary. (*Apiarium*, Lat. a bee-stand.) A bee-house.

The simplest form of an apiary is that of a few shelves placed in a recess in a wall, with or without shutters, to exclude the extremes of either heat or cold.

"The scientific, or experimental bee-house, differs from the common one in being formed with doors or shutters behind, to allow the hives to be inspected at pleasure. In each variety small holes about half an inch high, and from 2 to 3 inches wide, with a broad fillet in front as a landing-place, are made in each shutter, and opposite the door or entrance to each hive on the shelf, these external openings have sometimes a projecting fillet over them to throw off the rain which falls."

In the southern countries, the aspect which is preferred for an apiary is always to the eastward; but in England little attention is paid to the position; it is certain, however, that this should vary with the climate of the country, and in this climate it is found that five points to the eastward or south is the best.

In whatever position the apiary is placed, it should be protected from the winds; in England, therefore, a protection from the south-west is desirable; the high winds not only preventing the bees from leaving the hive, but they also surprise them in the fields, and often kill them by dashing them against the trees and rocks, or into the rivers.

The hives of an apiary should always be placed in a right line. but should the number of the hives be great, and the situation not capacious enough to admit of their being placed longitudinally, it is more advisable to place them one over another, than in double rows upon the ground, or bottom of the apiary. If the hives are to be placed in a double row, the apiary should be constructed that the hinder ones should alternate with, and be placed at such a distance from, the front ones, that when the bees take their flight no obstruction should be offered.

A few low shrubs should be planted round the apiary, but these should never be allowed to rise to a greater height than the entrance to it. In order to prevent the approach of insects, which are enemies to bees, the apiary should be surrounded with a small leaden reservoir of water.

The vicinity of great towns, or chimnies, is not to be preferred for an apiary; these last, besides their smoke, which is injurious, are also the resort of swallows and martins, the great enemies of bees.

An apiary should stand at a distance from walls and hedges, as in this situation the hives are liable to be infested with mice and snails; an open situation is the best. It should be placed to receive the rays of the rising as well as meridian sun, heat and light appearing to be the stimulants to the labours of bees; an apiary placed so as not to be touched by the sun, until some hours after its rising, would lose a proportionable part of each day's labour. A bee on leaving the hive generally forms an angle of about forty-five degrees with the horizon; the elevation of the entrance to the apiary should, therefore, be made about 2 feet from the ground, in order to clear the bushes which surround it.

Apiaries. Among the Romans, included that part of the garden in which the bee-house was placed, and which was planted with aromatic herbs and flowers; the collection of hives, or apiary, was called "castra apium." The beehive was bell-shaped, sometimes of the bark of the cork tree, a part of hollow, osier twigs, pottery, and transparent stone, (alabastrites,) that the bees might be observed at work; the hives had movable coverings, and placed on *podia*, or stands, to prevent the approach of reptiles. The situation against a high wall was chosen to keep off the cold winds.

Apis. The figure of a bull; a common ornament in Egyptian architecture.

An ornament resembling two wings, rounded with a broad plate, or parasol often attached, called *aspideion*, or *aspidiske*; sometimes a moving triton was affixed to mark the point of the wind. It was called *aplason* by the Greeks.

Aplustre. *In ancient naval architecture.* "A carved ornament fixed to the highest part of the stern; it is supposed to have been formed of various colours, and to have answered the purpose of a flag or ensign." See the engraving marked *Acrostolium*, for examples of the aplustre, or aplustrum.

Apodyterium. (*Apoduein*, Gr. to undress.) A room at the entrance of the ancient baths, or in the palæstruæ, where persons dressed and undressed, who were going into the bath, or to practise gymnastic exercises.

In Nero's baths the apodyteria were small square apartments near the sphæristrum; but the apodyterium of the bath was near the hypocaustum, and consequently very warm. In the baths of Titus this apartment was oval; in those of Domitian it was a parallelogram partitioned by columns, forming an entrance on each side, one to approach the xystus, and the other the vestibule before the apodyterium. In the thermes, or baths, of Caracalla it was of magnificent dimensions, and decorated with columns; it was placed between the xystus and the rotunda containing the warm bath. In the baths of Diocletian the apodyterium was circular, and adorned with lofty columns. The Romans also called this apartment, or division of the public baths, spoliarum, and here they also anointed their bodies before they resumed their habits.

Apollodorus. A native of Damascus, who flourished under the reign of the emperor Trajan, was much employed as an architect by that prince in designing and erecting his splendid buildings; his greatest work was the bridge across the Danube.

Apollodorus is celebrated as one of the few "independent architects," but his practice has been urged by some of another stamp as a beacon to be shunned, rather than a model to be imitated. "In good truth he was a right able and expert architect, but indiscreet withal. Was there not a grievous lack of urbanity in his answer to that most powerful emperor Adrian? 'If the goddess thou hast placed in thy temple,' quoth this master-builder to the king, (who was seeking his counsel on a design of his own limning,) 'should wish to rise and take an airing, she must break her head on the ceiling.' Shortly, thereafter, the potent emperor took the scornful artist's *own head* from him."

Apoteichismus. (*Apoteiko.* Gr.) *In ancient military architecture.* A double wall or rampart of earth, raised by the besiegers close to the place invested. The inner wall preventing sudden sallies from the town, and the outer the approach of enemies to the relief of the besieged,—answering to the lines of contravallation and circumvallation, among modern military architects.

Apothesis. A place on the south side of the chancel in ancient churches, fitted up with shelves, on which books, vestments, and other things were deposited.

Apotheca. (*Apotheken*, Gr.) *In ancient Roman architecture.* A cabinet, cupboard, cellar, or storehouse, in which were kept oil, wine, and other things. *Apotheca-vinariæ*, a garret exposed to the sun, in which some kinds of wine were ripened.

Apophoreta. A movable stage or box to carry relics.

Apophyge. Apothesis. Apophysis. A concave quadrantal moulding joining the shaft of a column to the base, and connecting the top of the shaft to the fillet under the astragal; the small fascia or bend at the top and base of the shaft of columns. The introduction of this member is supposed, by a learned translator of Vitruvius, to have arisen from the use of iron rings with which the tree-columns of early days were bound to prevent their splitting; the Greek word *apophege* signifies an *escape* or remedy. Chambers defines it to be that part of a column between the upper fillet of the base, and the cylindrical part of the shaft of a column, which is usually curved into it by a *cavetto.*

Apotheosis. *In decoration.* An ornament representing the ascent and reception of some ancient hero, among the gods.

Appian-aqueduct. See *Aqueduct.*

Appian-way. See *Road.*

Apsis. The bowed or arched roof of a house, room, or oven. The canopy of a throne. The inner part of ancient churches where the clergy were seated, and in which the altar was placed, in opposition to nave, where the congregation was assembled. It is synonymous with *concha, camera, presbyterium*, or what we now call choir, or sanctuary. This part of the church, from being built in a circular arcade, or vaulted, was called *aphis* by the Greeks, and *absis* or *apsis* by the Romans. Isidorus derived it from the Greek work *aptein*, *to enlighten* as this portion of the church was better lighted than the other parts.

The apsis, built in a hemispherical shape, consisted of two parts—the altar and the presbytery or sanctuary; the bishop's throne was placed in the middle of the semicircle. The altar placed at the other extremity, towards the nave, was separated from it by a grating or balustrade, and elevated upon a platform.

The throne of the bishop being anciently called apsis, is thought to have given its name to that part of the church in which it was placed; but it is more probable that it received its name from its situation. It is still called *apsis-gradata* from being raised a few steps above the seats of the priests.

Apron. (*a soran*, Sax.) A platform or flooring of plank raised at the entrance of a dock, a little higher than the bottom, against which the dock gates are shut.

In naval architecture, a piece of curved timber fixed behind the lower part of the stern, immediately above the foremost end of the keel; the apron conforms exactly to the shape of the stern, so that when the convexity of the former is applied to the concavity of the latter, it forms one solid piece, which serves to fortify the stern, and give it a firmer connection with the keel.

As the apron is composed of two pieces scarfed together, and used to support the scarf of the stern, it is necessary that the scarf should be at some distance from that of the stern. It is formed of the same thickness with the keel of the stern; but its thickness is equal throughout. Sometimes the piece immediately under the apron forms a curve, of which the horizontal part covers the dead wood, while the vertical part corresponds with the inside of the stern to which it is forged, making the commencement of the apron.

Apron. *In plumbing*. See *Flashing*.

Apron-piece. *In carpentry*. A horizontal piece of timber in a wooden double-flighted stair, supporting the carriage-pieces and joistings in the half spaces or landings: they ought to be firmly fixed in the wall.—See *Pitching-piece*, and *Stair*.

Apron-lining. *In joinery*. The facing of the apron-piece.

Apostolæum, or Apostolium. A church called by the name of an apostle.

Apuleius. An ancient Roman architect, who built the temple of Tarragona, in Spain.

Aquaminarium. See *Amula*.

Aqueduct. An artificial channel made for conveying water from one place to another, either under ground or above it, without employing any other mechanical principle than that water will descend along an inclined plane. A structure continuing the line of a canal for the passage of ships across rivers or vallies.

The construction of aqueducts is treated upon by Vitruvius and Pliny, and their description is curious, not only as giving the methods used by the ancients in those stupendous works, which were considered to be among the greatest of the wonders of Rome, but as indicating a knowledge of some hydrodynamical laws, the discovery of which are usually assigned to a much later period.

"Ducts of water," according to Vitruvius, were of three kinds. Channels of masonry leaden pipes, or tubes of fictile ware, according to the following rules:—When channels are used they should be made as solid as possible, and the bed of the stream should have a descent not less than a half a foot in 100 feet, and they should be arched over, that the sun's rays may not touch the water. When the water arrives at the city a *castellum* or reservoir is built, and a triple emissary to receive the water is adjoined to it. In the castellum are three pipes equally disposed within the adjoined receptacle, so that when there is too much water, it may from the side ones be discharged into the middle receptacle. In the middle chamber are fixed the pipes leading to all the cisterns or fountains, in another those to the baths, which pay to the people a yearly tribute, and in a third those to private houses, if it be not wanted for public use, for they could not return it if they might have peculiar ducts from the spring head: this disposition is established, because by the tax on that carried to private houses the state keeps the aqueducts in repair.

But should mountains intervene between the city and the spring head, a subterraneous passage is to be dug through the earth, having the declivity of one part in two hundred, and should the soil be either gravel or stone, a channel is to be cut into it, but *walls* are to be built to conduct the water through *the earthy or sandy* soils. Wells also, or air-holes, are to be made there, cut from the top of the water channel to the surface, for the purpose of allowing the *air* which might *accumulate* in the aqueduct to escape. These wells are directed to be placed at a distance of 120 feet.

If the water be conducted by leaden pipes, a castellum or reservoir is first built at the spring head, then the diameter and strength of the pipes being suited to the quantity of water, they are to be carried from this castellum to that which is in the city. The pipes were directed not to be less than 10 Roman feet in length, and were named from the breadth of the lead before it was bent round into the form of the pipe.

The manner of conducting water by pipes of lead is thus regulated, if the spring head had a sufficient current to the city, and no higher hills intervened. The interval is by walling raised to a proper level, as mentioned in the description of channels of masonry, or else a circuit round may be taken if not very long; but if there be frequent vallies the *courses* are to be directed *down the declivities*, and when arrived at the bottom a substructure is to be built, but not high, that the libramentum (or level, or counterpoise) may be as long as possible; this will be the *venter*. When arrived at the opposite declivity, as on account of the length of the venter the water swells gently, it is *pressed upward to the top of the ascent*; whereas if the venter should not be made in the valley, nor a substructure built level, but should be bent, the joints would be broken and destroyed. In the venter also *columnariæ* are to be raised, through which the force of the vapours may be dissipated. These columnariæ are supposed to have been vent-pipes for the air, and to have been always open at the top, and to reach above the level of the aqueduct.

It was also not unusual when the level from the spring head to the city was obtained, to erect a castellum at every 260 actus' distance, that if damage should happen at any place, the whole work needed not be taken down, and that the defective place might be the easier found. But those castellums are directed neither to be built in the decursions, nor in the plane of the venter, nor in the pressures, (or that part of the aqueduct where the water rises, or is raised upward by the weight or pressure of the descending water,) nor in any of the vallies, but always on the even plane. But when it was required to conduct water at a less expense, *tubes of earthenware* were made, having a thickness of not less than 2 inches, and these tubes were so formed, that one end being tongued, the one entered the other: — then the joints were cemented with quick lime tempered with oil. In the descents level with the venter, a stone of the red kind is placed at the angles so perforated, that the last tube of the decursus, and first on the plane of the venter, may be joined to the stone; so likewise at the opposite acclivity, the last in the plane of the venter, and the first of the expressure, are to be in the same manner united to the red stone. Thus the tubes on the even plane, as well as those in the decursus, will not be split, for such violent vapours are apt to rise in conduits of water as would even burst through stone, unless the water was at first gently and sparingly admitted from the spring, and the bendings secured with ligatures, or weights of ballast; in all other respects they are laid in the same manner as leaden pipes. When first the water from the spring is admitted, ashes are sent before it, that if any of the joints should not be sufficiently cemented, they may be stopped by the ashes.

Aqueducts of tubes, continues the Roman architect, have these advantages:—if any damage should happen, any person may rectify it, and water from earthen tubes is more wholesome than that from pipes, as the use of lead is found to be pernicious; we should not, therefore, conduct water in pipes of lead if we would have it wholesome. The taste also of that from tubes is better, as is proved at our daily meals; for all persons, although they have tables furnished with vases of silver, use fictile ware, on account of the purity of the taste.

If no spring were to be found whence to supply an aqueduct, wells were dug; and if no water was then met with, by means of *signine* work that from roofs or elevated places was preserved. In signine work these rules are to be observed: — first, the purest and roughest sand is to be provided, the cementum must be of flint stones broken, so as not to weigh more than a pound, and the lime must be the most ardent. It is so mixed in the pit, that five parts of sand must correspond to two of lime. The cementum is to be added in the pit; with this the walls of the well, as low as it is sunk, are, by the help of wooden levers armed with iron, to be plastered. The walls being plastered, the earth that may be in the middle is to be taken out quite to the bottom of the walls, and the ground being levelled, the pavement is to be laid with the same mortar to the intended thickness; if these places be laid double or triple, so that the water may be filtered in passing through them, it will be rendered more wholesome.

The signine work is conjectured to have been composed of lime, and the powder of tiles or bricks. Such a kind of mortar is elsewhere mentioned by Vitruvius, and directed to be used in damp situations, and the term is supposed to be derived from Signia, a town of Italy, where it may have been first used or invented.

We have no further description of the mode of forming ancient water-works, excepting short directions given by Pliny for water conduits. If, says this author, a man would convey water from any head or spring, the best way is to use pipes of earth made by the art of the potter; they ought to be two fingers thick, and one jointed within another so as the end of the upper pipes enters into the end of the under one, as a tenon into a mortise, or a box into the lid;—these pipes ought to be united and laid even with quick lime quenched and dissolved in oil. The least level to carry and command water up hill from the descent is 100 feet, but if it be conveyed by one canal only, it may be forced to mount 240 feet. As touching the pipes by means whereof the water is to rise aloft, they ought to be of lead,—this is also to be observed, that the *water always ascends of itself at the delivery to the height of the head from whence it flowed,*—if it be fetched a long distance, the work must *rise* and *fall* often, that the *level* may be still maintained; the pipes ought to be 10 feet long; the pipes were named from the number of fingers' breadth of which the sheet of lead was formed before it was turned into the shape of a pipe, and they were also to be of different thicknesses. In every turning and winding of a hill, the pipe should be five fingers round and no more, to repress and break the violence of the water in the current; likewise the vaulted heads which receive and contain water from all the sources meeting together, must be of that capacity that the supply requires.

In another place he directs to make good cisterns, which might hold water — that the mortar that is employed ought to be made of five parts of fine, pure sand and gravel, to two parts of the most fine and binding lime. The fragments of gravel or flints that may be employed should be small and not exceed the weight of a pound a piece; with mortar of this kind the bottom, side walls, and ends should be coated, and rammed down hard with iron beetles, or mallets.

This is the sum of the information left us by ancient writers, concerning the construction of conduits, and the principles followed by Roman architects in erecting those gigantic fabrics, some of which still remain striding across vallies, penetrating mountains and sweeping immense plains, till they meet in the heart of the city of Rome.

The first known works of this description were at Pheax, in Sicily, which were built of free stone, and covered by layers of stone projecting beyond each other.

The Romans, for four hundred and forty-one years after the foundation of their city, were contented with the turbid water which they drew from the Tiber, or that collected in banks, or from springs. For water derived from this last source, they manifested a strong partiality, owing to an opinion as to its superior salubrity, and to its great efficacy in the cure of diseases. The attention of the Roman government appears, at a very early period, to have been turned towards procuring a supply from other sources; but being ignorant of the use of hydraulic engines, by which water could be raised to any level, they accomplished this purpose by ascending to the source of the rivers in their neighbourhood, in order to obtain the necessary elevation for supplying the higher parts of the city, as well as from a preconceived notion, that the purity of the water was deteriorated in proportion to its distance from the fountain head.

Frontinus, a Roman author, who had the superintendence of the aqueducts in the reign of the emperor Nerva, has left a treatise on these erections. From his enumeration there were nine aqueducts which brought water to Rome in his time. The water of these varied in its qualities, that of some being preferred for drinking,—of others for bathing,—for irrigating the gardens, or cleansing the sewers.

The *Aqua Appia* was the first structure of this sort erected at Rome, and was begun about the four hundred and forty-second year of Rome, or three hundred and twelve years before Christ, under the direction of Appius Claudius Crassus, the Censor, with whom was associated C. Plautius, who had bestowed great care in tracing the sources for the supply of this water. Through some intrigue of Crassus, Plautius resigned his office before the works were finished, and they being carried on to completion under the sole superintendence of Crassus, he had the honour of giving his name to the structure. Appius is also said to have had the period of his censorship prolonged from time to time, until he had finished not only this aqueduct, but the celebrated Appian-way. The Aqua Appia was brought from a distance of about 11,190 Roman paces, and was carried along the ground, or by subterraneous lines, for 11,000 paces; about 190 of which were erected upon arches. Some minor springs were conducted into its channel in after-times by the emperors. Its level was high enough to supply the more elevated parts of the city, although great part of the advantage of the elevation of its source was lost by giving too great a declivity to the channel. It was carried along the sides of the hills, and had less of arch-work in its construction, than others that were afterwards erected.

The next in order of time was the *Anio Vetus*, begun by M. Curius Dentatus, about the year of Rome 481, from the spoils taken from Pyrrhus. The water was derived from the springs that flowed into the river Anio, above Tivoli in the mountains. This work having been interrupted for one or two years, it was proposed to the senate to complete it. To Curius, who had commenced the work, was now associated F. Flaccus; but the death of Curius soon after his second nomination, left the glory of its accomplishment to his colleague;—it was about 43,000 Roman paces in length, and in its course it had 931 paces of substructure, and 42,779 paces under ground.

About one hundred and twenty-seven years afterwards, or in the six hundred and eighth year of the foundation of the city, the works of the Aqua Appia and Anio Vetus, having gone into decay, and much of their water being abstracted by the fraud of individuals, the prætor Marcius was appointed, by the senate, to repair the injuries and to reclaim the water. But as the enlargement of Rome seemed to demand a greater supply than was furnished by these two aqueducts, Marcius was further instructed to bring other waters to the city by a conduit of larger dimensions than that of either of the others, and that this new water should be conducted to the capitol. To accomplish this, a sum of 8,400,000 sesterces were decreed to Marcius; and as the time of his prefecture was of too short duration to bring so stupendous a work to its termination, it was renewed to him from year to year. While the works were in progress, the decemvirs having consulted the oracle, reported that the Anio Vetus, instead of the new water, should be conducted to the capitol; but both at this time, and when the question was renewed some years afterwards, the project of Marcius was adhered to, and the *Aqua Marcia* was carried to the capitol. This water, which was the most wholesome of any conducted to Rome, was drawn from springs in the neighbourhood of Subiaco, on the Anio, twenty miles above Tivoli in the mountains, and was nearly 61,710 Roman paces in length; nearly 7,463 paces of this length were above ground, the remainder 54,247 being subterranean. A length of about 463 paces was supported on arches, where it crossed brooks and vallies.

To supply the Aqua Marcia in dry seasons, Augustus conducted another stream of equal goodness into its channel by an aqueduct 800 paces long.

"Of all the waters in the world," says Pliny, "that which we call in Rome the Marcia, carrieth the greatest name by the general voice of the citizens, in regard both to its coldness and salubrity, and we may esteem this water for one of the greatest gifts that the gods have bestowed upon our city. In times past it was called Auffeia: the first that began to bring this water to Rome was Ancus Martius, one of the Roman kings, and it was afterwards finished by Q. Martius in his prætorship; compare the Virgo to the Marcia, and you shall see the difference between the coldness of the waters; for look, how cold Virgo is to the hand, so much is Marcia in the mouth. But long ago we of Rome have lost the pleasure and commodity of these rills, through the ambition and avarice of some great men, who have turned away these waters from the city where they yielded a public benefit to the commonwealth, and derived them for their own profit and delight, into their manors and houses, to water their gardens and other uses."

Nineteen years afterwards, the *Aqua Tepula* was brought to Rome: it also derived its waters from springs communicating with the Anio; it was not more than 2,000 Roman paces in length.

In the reign of Augustus Cæsar, Agrippa collected some springs and conducted them to Rome, by the aqueduct of the Aqua Tepula, but as the latter water flowed in a separate canal, it preserved its name in the distribution; it was 15,426 paces long, 7,000 paces were above ground, and 6,472 paces of this length were on arcades. This water was named *Aqua Julia* by Agrippa.

Independently of the source of the Aqua Julia, another stream was found near the same spot, which was left untouched by Agrippa, as it appeared to him to belong to the inhabitants of Tusculum. This water was at first distributed every alternate day to the villas in the neighbourhood; but in the course of a short time, the fountain-keepers contrived to divert the supply into the channel of the Aqua Julia. To remedy this abuse the use of it was interdicted, and the houses at Tusculum were supplied with it as formerly. In the same year of Rome, 719, Agrippa reestablished the almost ruined aqueducts of Appius, of Marcius, and the Anio Vetus, at his own expense, besides erecting several flowing fountains in the city.

The *Aqua Virgo* received its name from the circumstance of a girl having pointed out to the soldiers, who were engaged by Agrippa in exploring the neighbourhood, the sources of streams, which were collected, and found to yield a great supply of water. In a small temple erected near the spot, the occurrence was commemorated by a painting. The different springs were surrounded with a brick wall, and in their course were augmented by the accession of several streams, and the united waters were carried to Rome by an aqueduct about 14,105 paces in length, the part under ground 12,865, above ground 1,240, of this 700 paces were arcades.

The *Aqua Alsietina* is drawn from a lake of the same name by an aqueduct twenty-two and one-fifth Roman miles in length; in this distance it contained three hundred and fifty-eight arcades or arches. It is difficult to imagine, says Frontinus, what could have induced a prince so sagacious as Augustus to bring this water to Rome, for it has no good quality, it is unwholesome, and was not applied to any public use: unless it arose from his unwillingness to turn any of the salubrious waters into his naumachia, to which use he destined the Aqua Alsietina, and the superabundance was drawn off to water the gardens and for similar uses. However, during the repairs of some of the aqueducts, and the consequent deprivation of water which this occasioned, recourse was had to the Aqua Alsietina—which was also sometimes called Augusta—its aqueduct was 22,172 paces from its source to the city, and in this length 358 paces were arcades.

After these, no other aqueducts were constructed at Rome until the time of Caligula. At this period the seven existing aqueducts being found inadequate to the supply of the city, this emperor began the erection of two others in the second year of his reign; these were finished by the emperor Claudius with great magnificence, and opened to the public in the year 803 of the foundation of Rome. The first of these aqueducts, which was drawn from the fountain Cærulea, was named *Aqua Claudia*, and the second *Anio Novus*, to distinguish it from another bearing the same name, and which was afterwards called Anio Vetus, or the most ancient.

The source of the Aqua Claudia is two fine and abundant springs. The water received in its course another stream having equally good qualities, and which could be mixed with the Aqua Claudia without altering its qualities. As the Aqua Marcia seemed equal to the supply of the district to which it was appropriated, the Aqua Augusta was turned into the Aqua Claudia; but in such manner, that in cases of emergency it could be directed into either the one or the other. See fig. 14.

The Aqua Claudia was 46,406 Roman paces in length, of which 36,230 were subterranean, and 10,176 paces were on arcades; near the city there was a series of arches 491 Roman paces in length.

The *Anio Novus* was derived from a stream of the same name, but having its course through rich land, and traversing cultivated fields, in times of rain, it was mixed with great quantities of mud. On this account a purifying piscina or reservoir was interposed between the mouth of the aqueduct and the river, in which the water reposed to clarify, before it entered the channel of the aqueduct; but in spite of this precaution, as often as it rained, it was discoloured when it arrived at the city. Another streamlet, whose waters were remarkable for their transparency, was conducted into the Anio Novus; but at these seasons its advantages were lost by the mixture.

The Anio Novus was 58,700 Roman paces in length, 49,300 of which were subterranean; of the 9,400 paces of works above ground are 6,491 paces of arches; these are more elevated than in any of the other aqueducts, some of them being 109 Roman feet high.

All these aqueducts were carried to Rome on different levels and their waters distributed to the several quarters of the city to which their respective elevations were the most adapted. The Anio Novus flowed on the highest line; the next was the Aqua Claudia. The Aqua Julia was the third in rank as to elevation; the Aqua Tepula the fourth, and next to it the Aqua Marcia.

The Anio Vetus was in the sixth rank as to its level, but from the height of its source it might have been carried to supply the highest part of the city—the Aqua Virgo is lower, and the Aqua Appia lower still—the sources of the two last rising in the Campagna di Roma could not be conveyed at a much higher level. The Aqua Alsietina, on the lowest level of all, was distributed in quarters about the Tiber and in the lowest places.

The point of distribution of the Anio Novus above the level of the Tiber was 158·88 feet, that of the Aqua Claudia 148·9 feet, the Aqua Julia 129·4 feet, the Aqua Marcia 125·4 feet. The Anio Novus arrived at Rome 82·5 feet above the same level, the Aqua Virgo 34·2 feet, and the Aqua Appia 27·4 feet; the level of the Tiber being 91·5 feet above the level of the sea. The earlier Romans thus appear to have conducted the waters at a lower level than their successors, either from an ignorance of the mode of drawing the exact level, or as a precaution, by which they were enabled the better to conceal the conduits by burying them in the earth, that they might not be destroyed by enemies in those times when they were often at war with their neighbours. In the time of Frontinus, when these conduits were useless from dilapidations through age, in place of renewing the channel in the old line, it was often conducted by arcades across vallies to shorten the lengths of their courses.

The Romans also at all periods gave a greater declivity to their water conduits than is practised among the moderns. Vitruvius, as it has been stated, directs a fall to be made of half a foot in 100 feet of length. Scammozi says that it was the practice of the Romans to allow a fall of 1 in 500.

A modern engineer who measured some of the remains of these buildings to determine this point, states that he found the *mean fall* of the ancient aqueducts, from the purifying piscinas, or reservoirs, to the point of distribution, to be 0·068 English inches to each "pas Roman," or nearly 1 in 663, and that from the source of the stream to the purifying reservoirs the mean fall was ·0·132 English inches for each Roman pace, equal to about 58·219 English inches.

Thus the *Anio Novus*, the pavement of whose water-channel, at its arrival at Rome, is (158·88 feet above the level of the Tiber added to 91·5 feet) 250·3 feet above the level of the sea, has a fall of 5·2 feet from the purifying piscina to the point of distribution at Rome, and a rise of 568·7 feet from this reservoir to its source, giving a height of 824·2 feet for the source above the level of the sea.

The *Aqua Julia* delivering its waters at 220·9 above the same level, has its source elevated to a height of 333·2 feet, and that of the Aqua Tapula about 329·3 feet.

The *Aqua Marcia*, according to Frontinus, arrives at Rome at a lower level than the Aqua Julia, but its source is higher than that of the Aqua Claudia. From the point of distribution to the purifying piscina, is a rise of 51·3 feet, and from that to its source a rise of 601·8 feet, which, added to the height of its point of distribution, gives 867·4 feet as the level of its fountain head above the sea.

The *Aqua Virgo*, according to the same author, had a fall of nearly 112 5 feet which gives 238·2 feet for the elevation of its source Fr.

The *Anio Vetus* has been estimated by the same architect to fall 0 1173 inches in a Roman pace; this will give 593·4 for the height of its source above the sea.

The Aqua Appia, estimating by a fall of a line in the Roman pace, gives 210·1 feet as the height of its summit level.

The *Aqua Alsietina* by allowing 1½ lines F. for each "pas Roman," had a fall from its source to its point of distribution of 223 feet Fr.

Six of these waters emptied themselves into reservoirs or piscinas at a certain distance from Rome, where they deposited their sediment, and where their quantity was determined by a register. Three of these, the Aqua Julia, the Aqua Marcia, and the Aqua Tepula, were conducted in the same aqueduct from the piscina; the most elevated was the Aqua Julia, the next the Aqua Marcia, and the third the Aqua Tepula.

The Anio Novus, and the Aqua Claudia, also flowed from their piscinas on lofty arches, the Anio Novus being over the other; these two waters were conducted by pipes into different quarters of the city. The Anio Vetus was carried from its purifying reservoir on a separate series of arches.

Neither the Aqua Virgo, Aqua Appia, nor Aqua Alsietina, were furnished with piscinas.

At this period it would appear, that after a heavy fall of rain, the greater part of the water flowing into the city by all the aqueducts, was discoloured by being charged with earthy matters even in some of them that were pure and limpid at their sources.

This impurity was particularly observable in the aqueducts called Anio, which were drawn from a river, that was sometimes turbid, although flowing from a lake of great purity and transparency; this inconvenience was not only felt during the rains in winter and spring, but during summer, a season in which the limpidity of water is particularly agreeable, and was essential to be preserved; indeed the Anio Vetus was always discoloured, but this was of smaller consequence than in the case of the Anio Novus, because running on a lower level. The impurity of the Anio Novus was of great disadvantage, as it discoloured the waters of other aqueducts, into which it entered to supply their deficiencies in dry seasons; besides, through the carelessness of those who had the direction of the fountains, the Aqua Marcia, among others, arrived at Rome mixed with it; this was among the most agreeable of any water brought to Rome from its coolness and transparency, but in consequence of the mixture, it was employed for baths, and sewers, and other common uses.

Nerva, however, found means to purify the water of the Anio Novus, by ascending the river to a point where it flowed over a rocky bed only:—here a reservoir was constructed, into which the water was admitted, before it was conducted into the aqueduct. The Aqua Novus, which heretofore had been one of the worst at Rome, was now equal to the Aqua Marcia in transparency and coolness, and its source was steady and abundant beyond any of the others.

Nerva constructed a number of wells in the courses of the other aqueducts, in which the water was introduced in order to allow the sediment to fall to the bottom.

Under the reign of the same emperor, other regulations were established in the general distribution of the water, and a considerable increase was nominally made in the quantity indicated by the registers.

The Emperor Nerva also classed the aqueducts as a means to remedy the improper use of the different waters:—the Marcia was placed in the first rank, and reserved solely for domestic uses; the others were assigned to those purposes for which their qualities were most proper, and the Anio Vetus, as being the most impure, was consigned to the common purposes of the public sewers, drains, &c.

The quantities of water which were furnished by the nine aqueducts are given by Frontinus, from a measurement at the head of each aqueduct, except in the cases of the Aqua Julia and Virgo, which he states from the quantity delivered by the registers:—

Anio Vetus	4,398	quinariæ
Aqua Marcia	4,690	
Aqua Virgo	2,524	
Aqua Julia	1,368	
Aqua Claudia	4,607	

Anio Novus 4,738 quinariæ.

Aqua Alsietina is not stated, although the quantity was considerable: however, the quantities delivered as by the public registers did not amount to more than 14,018 quinariæ, the remainder being surreptitiously abstracted by fraudulent individuals. This diminished quantity has been stated as equal to 27,743,100 English cubic feet, which, estimating the population of ancient Rome at a million, which it is thought probable it never exceeded, gives no less than 50 cubic feet daily for the supply of each inhabitant; yet this was not, probably, more than the half of the entire quantity which was conveyed by aqueducts to the city. The abundance of the supply will best appear from a comparison with that of London. In 1790 this was estimated as equal to 2½ millions of cubic feet daily, and now, through the rivalship of different companies, it may amount to nearly 4 millions of cubic feet, a supply which is found to be sufficiently ample for all the uses of a luxurious population, equal in number to that of ancient Rome,—yet the supply of the latter was nearly seven times greater, estimating by the reduced quantity, and double that by the true, and prodigiously greater than that of Paris, where the whole quantity distributed among six hundred thousand inhabitants does not exceed 294,000 cubic feet, scarcely half a cubic foot to each person.

Notwithstanding this prodigious abundance of water supplied by the aqueducts, and which Strabo compares to rivers flowing along the streets, and through the sewers, and that from these almost every house had a water-pipe and cistern, constantly supplied, the use of well or spring water, would appear always to have been considerable. For many hundred years afterwards, during the siege of Rome by Vitigis, those citizens who were far from the river, after the aqueducts had been destroyed by the besiegers, are related to have had a copious supply from the wells.

We learn from Frontinus, that these buildings were subject to very rapid dilapidation, and that the expense of preserving them in proper repair was very great. These were occasioned, he says, by age, by the cupidity of the proprietors of land through which the aqueducts were conducted, by the violence of tempests, or by the giving way of imperfect, or insufficient erections. This was the greatest evil in the more recent constructions; and from enforcing in a particular manner, that, as a general rule in the choice of materials, the employment of tuffa in the wall of the piers was to be avoided, on account of its being liable to be crushed under a great weight, we may infer that was no uncommon occurrence. The aqueducts, or that part of them which was conducted on arcades, suffered considerably from storms—more especially the parts which were constructed on the flanks of mountains; but those portions demanded the greatest care which were formed on arches under which a river flowed. The subterranean parts were the easiest to keep in order, as they were neither subject to the action of the frost, nor, what was of almost greater effect, to the action of intense heat.

A considerable source of repair arose from the adhesion of the sediment to the sides and bottom of the water channels, and which formed a hard and thick crust which greatly obstructed the passage of the water; and by considerably raising its level, occasioned breaks in the channel which not only destroyed it, but also the sub-erections of every kind to which it approached.

The reparations of every kind were if possible suspended during the summer season, as at that time the supply of water was the most necessary—the spring and autumn were the working periods. This was particularly observed in forming masses of masonry—for a moderate temperature was found to be of advantage, as permitting all parts of the masonry to be laid with that humidity which was considered to be essential to the proper solidity of the work—a burning sun being esteemed by Roman masons, as hurtful to mortar as the action of frost—above all, it was a rule to provide before beginning any reparation every thing that could be required on the spot, and in sufficient quantity to ensure a rapid execution.

To preserve these stupendous erections from dilapidation, Agrippa, who was the first national superintendent, formed a class of slaves which was solely employed on the reparations—this at first consisted of two hundred and forty individuals—at the death of Agrippa the tribe was bequeathed to Augustus, who transferred his right in them to the public. Claudius established another company of "*Fountaineers*," during the erection of his aqueduct, this amounted to about four hundred and sixty persons. These tribes were composed of different classes of individuals—comptrollers, keepers of the castellum, inspectors, paviors, stuccoers, and other workmen; a part of these were lodged near the city, in order to execute with promptitude those alterations which, without being extensive, demanded instant attention—others were stationed near the reservoirs or castella, or in the neighbourhood of the public shows, to supply water to any point where it might be more particularly wanted, and their maintenance was paid by the public, by a rate on domains and houses.

The first figure in the plate marked "*aqueduct*" represents an arch of the Aqua Claudia, the width between the piers is 19·4 feet, the width of the piers 14·5 feet, their thickness 10·7 feet, their height 50·7 feet; the diameter of the arches is 20·5 feet, the entire height of the aqueduct 62·4 feet. The water channel is 5·8 feet deep and 4·2 feet wide.

The arcades, however, are not equal, varying from 18 feet to 27; their width seems to vary in proportion to their elevation.

The brick arches shown in figures 2 and 3, are those constructed by Nero to conduct the Aqua Claudia near the temple of Claudia. The space between the piers is 26·3 feet, the width of the water channel is 1·1 feet, its height 4·8 feet, the thickness of the arch is 1·6 feet; and the thickness of the pier is 5·6 feet.

Figures 4 and 5 are part of the arcades, supposed by Fabretti to be the remains of an aqueduct, which he names Alexandrina, because it was constructed by Alexander Severus. The figure 4 is in the Pantano marshes, the water channel shown in section, 2·9 feet. Above the voussoirs runs a projecting fillet of brick.

Figures 6 and 7 are two ranges of arcades faced with brick, supported by square piers 95 feet.

The space between the piers is 12 feet, the arching bricks are 2 feet long. In this part the water channel is 2½ feet wide.

Figures 8 and 9, an elevation and section and plan of part of the aqueduct of the Aqua Marcia. The channel is 2½ by 5½ Roman feet, and the walls 1¼ feet thick on each side; the outer face of the wall marked B is in collatino stone of a red colour, the part marked C of stone from Tivoli, the rest of the work being formed of the stone called "digabino."

Figures 10 and 11 are a plan and section of an ancient reservoir, attached to a cistern near Rome of rubble masonry faced on the outside with small unhewn masses of tuffa, and lined on the inside with a very hard cement, with the angles rounded, both at the sides and bottom. Its dimensions are 29 feet 1¼ inches, Fr. by 28 feet 8½ inches, Fr.; the water flows into it through a pipe at *x y*, and passes into a cistern W. In order to strengthen the walls of the reservoir and to counteract the pressure of the water, counterforts, of a length proportioned to the height of the walls, have been formed on three sides, having the intervals on the horizontal section formed of a portion of a circle.

The figures 12 and 13 represent the plan and section of another reservoir, covered by a semicircular arch, supported on three sides by walls strengthened by counterforts formed like niches; this was also formed as represented by the former figure, with revetments of rough stones, and coated with cement on the inside; a semicircular hole was made in the centre of one of the niches, to give light to the reservoir. The water entered through a leaden pipe at C. As the use of these reservoirs was to purify the water, it is probable that orifice of the pipe by which it entered was placed near the bottom of the cistern, so that the introduction of the impure water would not affect that on the surface, from which part it was probably drawn off by the opening D.

Figure 14, a section of the lower part of a cistern of two stages. It is divided into three compartments separated by reticulated masonry and banded by long bricks. H an opening about 2 feet wide, faced with brick, by which the water rose to the upper stage. F F, openings for the purified water to flow into the canal of the aqueduct; the bottom of this channel is 6 French feet above the pavement, the opening in the compartment, *g*, is on a lower level than that of the centre.

The figure 15 represents a purifying reservoir formed in two stages, which is conjectured to have served for the Aqua Virgo by Fabretti, although Frontinus remarked, that in his time this water had no piscinas. A, the aqueduct, which conveys the stream into the upper channel C, the opening by which it descended to the under chamber. E an opening communicating with the compartment, G an opening through which the water ascended to the chamber H, and L the opening by which it again entered the water channel. K is an orifice through which the sediment was abstracted.

These useful and stupendous erections were not solely confined to the capitol; few cities of any note in the Roman provinces appear to have been without one or more aqueducts. Among those important from their magnitude and fine state of preservation, may be reckoned those erected in Gaul.

The aqueduct at Nismes is probably one of the earliest that was constructed by the Romans out of Italy. Its origin is attributed to Agrippa, who was invested by Augustus with the government of this city, which had become a Roman colony. Flattered by the attentions of the citizens, Agrippa made their city his place of residence, and which he adorned with new city walls and magnificent baths. Those who suppose that the object of the aqueduct was to conduct water to the amphitheatre only, instead of being appropriated to the domestic uses of the inhabitants, have not regarded with attention the peculiarities of its construction. The simplicity and unornamented style of its architecture, perfect, however, in its proportions, and just in every point of its design, marks the very character of these works of Agrippa. The waters about the colony of Nemausus from the disturbed state of the springs in winter and spring, from the muddied flow of the torrents in times of flood, and the deficiency of the streams in times of drought and summer, were precarious, unhealthy, and insufficient; a colony so placed would be left very imperfect, nay defective, without the means of obtaining salubrious water; accordingly we find an aqueduct and fountain at Nismes, bringing a constant and copious supply unmixed with any of the streams or rivers that might spoil it. To avoid this it was brought from the mountains, excluding all communication with the waters of the country through which it passed, and where it became necessary to pass the deep valley in which the river Gardon runs, it was conducted across that valley by a bridge of two stages of arcades at a height of 150 feet above the ordinary level of the river, that is, measuring to the top of the second range of arcades, which perfected Agrippa's erection, the water being conducted on the top of the second arcade. The third story, part of which is now remaining raised upon a range of arcades, has been thought to be a building of a very different age from the two main ranges both in its materials, in its structure, and proportions; and even in the placing of its parts, it does not correspond with the old original bridge on which it was erected. The style of the architecture is also said to be very different, and very inferior to the rest. Although an adventitious addition, it is clearly Roman work, probably of a much later age.

The length of this aqueduct, as far as discovered, is about six French "lieues de poste," in a direction resembling a horse-shoe, and derives its water from the springs of Eure and Airau, near the village of Uzès. The Pont du Garde is in the middle of its course; the greater part of the ancient line can now be traced, and much of what remains is in a fine state of preservation. The observation made with regard to the parts of the aqueducts of Rome which were under ground, being in the best state of repair, applies with still greater force to the aqueduct at Nismes—the subterranean parts being even now in perfect preservation. The line was carried along the sides of the hills, which were occasionally perforated to shorten the distance and, where necessary, the lesser vallies were crossed by the erection of small bridges, or arcades preserving the level of the aqueduct. The greater portion of the excavated part has been cut through the stone strata of which the hills are composed, in some places at a distance of about 13 feet beneath the surface.

The Pont du Garde is that part of the aqueduct of Nismes which traverses the deep valley in which runs the Gardon or Garde between the mountains near Vers and St. Bennet.

This part, considered even alone, is one of the grandest erections made by the Romans in Gaul. The first row of arcades, beneath which runs the Gardon, is composed of six arches, the second row has eleven arches, and the third range has thirty-five; all these arches are semicircular, springing from piers, more or less high:—it was upon the third range that the water channel was formed according to some antiquaries, and we have adopted their suggestion in the figure.

According to the measurements of a French engineer, the height of this aqueduct-bridge is about 48 metres above the low water level of the river. Its length on the level of the moulding, terminating the first range of arcades, is 171·22 metres, and 269·1 metres on the level of the moulding terminating the second story.

The total height, according to the same author, is 48·77 metres, namely, 20·12 metres for the first range, 20·12 metres for the second range, and 8·23 metres for the third range to the top of the flags covering the water channel; the width of the bridge is 6·36 metres at the first range, 4·56 metres on the second, 3·6 metres on the third, forms a considerable offset on each stage; the five piers of the first range of arcades were formed with salient angles or *becs*. The division of the arches on the first and second stories is the same; the middle arch of the first range, under which the river passes, is the centre of the entire aqueduct, is 24·52 metres in diameter, three on each side are 19·20 metres, and the others 15·55 metres. All the arches on the third range or story are equal, being 4·55 metres in diameter; the piers of the first and second series of arches are 4·55 metres in front; those of the third range vary according to the diameter of the arches of the range beneath them; four arches of the third range corresponding with the middle or water way of the lower story.

As the two mountains forming the valley of Gardon are not of equal height at the points in the line of the aqueduct, that on the left side of the river being lower than the level of the aqueduct, while the right side is more elevated, the conduit on one side is carried onwards by continuing the third range of arches, and on the other side, the range terminates in the side of the mountain.

The Pont du Garde is constructed entirely with hewn stone: no rubble work is introduced even into the filling up of the piers or spandrils of the arches. The masonry has been finished and put together without lime, or any other kind of cement, and owes its stability to the mass of each block, and the precision of the faces in their beds and joints. The canal of the aqueduct is in fact the only part which is not constructed with hewn stones—being made with a sort of jointed rubble on the outer and inner faces of the canal, but of the common rubble in the filling up. This work, where the cement has not been sparingly used, forms a mass absolutely impenetrable to any passage of the water. The inside facings of the walls, and the bottom hollowed in the form of an arc of a circle, were covered with a coat of cement of 5 centimetres in thickness, composed of quicklime, fine sand, and pulverized bricks. This cement is at the present day of a consistence equal to that of the hardest, and most compact stone, and without the slightest crevice or flaw to be any where seen in it.—This first coat of cement was covered with a second layer of mastic very fine, of a millimetre in thickness, and of a deep, dark, red colour. The width of the canal between the outer coats was 1 metre 22 centimetres, and its height, 1 metre 22 centimetres.

The general declivity of the bed of the aqueduct was about 4 centimetres for 100 metres.

The aqueduct has been constructed with the same care throughout its great length, the only difference being that, in the parts exposed, the aqueduct was covered with slabs, and in the subterranean it was covered with a semicircular arch, of a species of rubble roughly squared in the joints, of 60 centimetres in thickness.

In examining the water channel, a stony concretion is observable, adhering to the cement on the sides and bottom. This petrifaction is nearly 29 centimetres thick, and from this it appears, that the general height of the stream of water in the channel was about 1 metre and 40 centimetres.

This interesting monument of ancient Roman magnificence, was demolished at its two ends some time about the beginning of the fifth century by the barbarians who then besieged Nismes; and who, by this means, endeavoured to force the citizens to surrender. It remained in this state until the beginning of the eighteenth century, when the duc de Rohan, in order to make a passage for his artillery, perforated the piers of the second arcade, and by some other operations directed to the same end, the Pont du Garde was rapidly falling to pieces. Considerable rents in the walls, and deviations from the perpendicular, exciting public attention, the provincial states took the matter into consideration, and by a series of judicious repairs, they succeeded in restoring this ornament of Languedoc to the state in which it was before the dilapidations of the duc de Rohan.

In 1746, the project of building a bridge near the site of this aqueduct was, fortunately for its further stability, modified so as to be built adjoining to it. M. Petot proposed to form this bridge on the eastern face of the Pont du Garde, and rigorously following the dimensions of the piers and arches of the ancient aqueduct, this was shortly afterwards erected, and the part marked A, on the section across the Pont du Garde in the plate marked *Aqueduct*, shows it.

Fig. 2, a section taken in the length of the aqueduct. Fig. 3, its plan. Fig. 6, a small plan of the bridge; and fig. 7 represents on a larger scale the details of the water way, or canal of the aqueduct: *a* is squared rubble stones. *b b*, two courses in hewn stone, forming a plinth or bed for the slabs, c, which were laid on them. The dotted lines, *d d*, show the petrifaction adhering to the side of the water channel.

Aqueduct at Lyon. Nothing gives us a higher idea of the ancient splendour of the city of Lyon (*Lugdunum*) under the emperors, than the remains of its ancient buildings, temples, palaces, amphitheatres, naumachias, baths, and, above all, its aqueducts, erected during the reigns of Augustus, Tiberius, and Claudius, to supply that part of the ancient city with water which was situated on the heights. The most ancient, that erected by the troops of Marcus Antoninus, drew its waters by two branches, from the group of hills called in modern times Mont d'Or: this stream having been found inadequate for the proper supply of even the highest division of the city, a second aqueduct was constructed, which drew its water from the Loire. The third aqueduct was formed under, to conduct water to the highest part of the city, on which was erected the palace built by the emperor Claudius. Remains of other minor aqueducts built in the same age are on the same construction, the arches and parts apparent being of the masonry called by the ancients *opus reticulatum.* A fourth aqueduct, formed along the bank of the Rhone, appears to have been the source from which the lower city received its supply of water; and from its remains there is little question but that it also was constructed by the Romans. The Claudian aqueduct, being that which has most attracted the attention of antiquaries, will be described more in detail.

The body of the work, that is, the arcades that carried the aqueduct across the vallies, is built of masses of rubble stone and cement, faced, as has been stated, with the *opus reticulatum.* In this instance, this kind of work is supposed to have been formed by laying a bottom of brick, of two, three, or four layers, then a caisson of wooden sides was applied to it, and fixed thereon. The caisson was first lined with the squared stones which were to form the face; the middle was then filled with rubble stones, into which a liquid cement of lime, fine gravel, and water, beaten up to a perfect degree of incorporation in its liquidness, so as to become a binding cement, was poured, and in that state entered into every interstice of the rubble work. This operation being repeated, the whole was wrought into one incrusted rock, harder than either of the materials themselves separately were. One can conceive, says a learned antiquary, how a careful beating together of these materials had the effect of creating so binding a cement, since we know from our own practice that puddling earth, fine gravel, and water together, form a lining for a canal that becomes impervious to water when once settled; and it was probably from this puddling, and not from any secret as to the materials of the mortar not now known, that this ancient cement owed its cohesive strength. When this square was set, the sides of the caisson were taken off, and another layer of bricks was then laid, and so another caisson, and so on. The bricks used in this construction were 1 foot 9 inches long, 1 foot broad, and 1½ inches thick; the cement of one of the aqueducts at the bottom is 6 inches thick, and 1½ thick on the sides: about 2 feet above the floor of the canal were fixed on each side cramps of three lines square, at 2½ feet distance from each other. The utmost breadth of the piers of the aqueduct of Chaponost, which carried a canal of 3 feet broad by 6 feet high, is not more than 6 feet, while the breadth of the aqueduct which passed over the river Baunan, and which has no canal, is 24 feet broad, consisting of two piers, each 5 feet, supporting an arch 14 feet in diameter.

M. Delorme, in his account, (*Séances de l'Académie*, 1759,) traced three of the aqueducts of ancient Lugdunum to their source, in three several tracks of many miles each. He examined their general level, and the level of each part, as they ran above and under ground, along the sides of the mountains and sides of vallies; and over the bridges where they passed the vallies, he observed the apparent care which the architects of these edifices took to avoid the building of works enormous in bulk, height, and expense, by carrying the walls up into the narrower and shallower parts of the vallies. Where smaller bridges would serve, and where they could carry the waters over a bridge by a rectilinear canal, they always built up bridges to that level; but where that would become too high, and yet where a bridge was necessary, they built bridges of a height sufficient to carry the water over in syphons of easy curvature.

The sources of supply of the aqueduct of Mont de' Pile, were from the waters of the river Gierre, from the rivulet of Sauon, and probably from the river Tanon, to which were joined those of the rivulet Laugoneau; after these waters were united in one stream at the aqueduct bridge of the little Varizelle, they make a long detour on the sides of the mountains and hills, till they arrive at the vallies which they must pass; yet here they are seen trained along the sides of these vallies, until they come to situations which are not so deep or so wide. It is then that the architects built bridges across the vallies, over which to conduct the waters, either in rectilinear canals, or in syphons; had this latter precaution not been taken, the construction of such bridges would have been of necessity so high as to become enormous both in work and expense; yet, notwithstanding all these precautions, there were in the aqueduct which takes its sources in Mont Pile, and determines at the gate St. Irenee, nine bridges carrying aqueducts, and three calculated to carry syphons.

The ninth is in a very deep and wide bottom, on the heights of Soncieu. The aqueduct, when it arrives at this bottom, is terminated with a reservoir at the south edge of the valley of the river Garon. The mode by which the water passed this profound chasm, was by causing it to flow from a reservoir on the one side, in leaden pipes bedded in the sides of the valley along part of the descent; it then flowed in continued pipes of the same sort, bedded on a bridge, whose top course was built in a descending or reversed curve; having thus passed over this bridge, when they came at a certain height, on the opposite side of the valley, they were protruded *up* in pipes bedded as before on the opposite sides of the valley, and the water was delivered into another reservoir on the top of this opposite hill, called the reservoir of Chaponost. From this reservoir the water entered into the aqueduct of Chaponost, which runs under ground along the west side of the village. It emerges on the north, and flows over a bridge composed of ninety arches, of which more than sixty, in Delorme's time, were remaining; this was terminated by a reservoir, whence the water, in like manner as before, descended by pipes into another valley, and in part passed it and the river Baunan over a bridge of a reversed curvature, and mounted again on the opposite side, there entering a second reservoir at St. Foi.

The waters flowed hence in a canal, carried by a bridge for some way above ground, and then became subterraneous, and continued thus along the heights to a point near the gate of St. Irenee. Here another reservoir was situated; hence the waters flowed in leaden pipes, which descended into the fosse of St. Irenee, and passing along the bottom of it, rose again, and emptied themselves into a reservoir, built near a spot which can be traced in the walls of the city, at the Mall of Fourviere, above the gate of Trion, on the south side of a square tower. These pipes were not carried across this ditch and valley upon a bridge, as has been stated by some authors; there are not the least vestiges of such; but they were bedded on a massive course of masonry. This aqueduct has a course of more than thirteen leagues; its distance, in a right line, is about eight leagues, and its descent from the bridge of the little Varizelle to the Fouviere, is 360 feet.

Delorme next describes the nature of these reservoirs placed on each side of those vallies, across which the waters were passed in syphons over a bridge of reversed curvature. The one is for holding up, or receiving, and thence emitting, the waters which are to be conveyed in pipes; and the other is to receive a sufficient quantity of water for distribution to the succeeding canal.

The *emitting reservoir* of the Garon aqueduct bridge is placed upon a quadrangular tower 14 feet long, and 4½ feet broad. The wall of the side next the valley is pierced at 9 feet above the bottom of the reservoir, with nine overtures, nearly oval, of 12 inches in height, and 10 in width. The piers of the walls, between these openings, were 7 inches thick. It was through these openings that the waters passed out of the reservoir by as many leaden pipes, which descended into the valley in part along the sides, and in part over arches rampant, that is, arches whose successive tops formed an inclined plane, which declivity was so regulated as not to have too sudden a descent. Hence they passed to, and over the bridge, and rose again on the opposite side in the same manner, and were inserted in the wall of another *receiving reservoir*. This receiving reservoir differed from the emitting one only in this, that it held the waters flowing towards the bottom of its basin, and the emitting one poured them out from the upper part, about 3 feet from the bottom, so that while the water rose in the emitting reservoir to 3 or 4 feet, that in the receiving one would not rise more than 2 feet. The nine leaden pipes, through which the water flowed, had each 8 inches diameter in the clear; the thickness of the lead, of which they were composed, was about 1 inch.

Delorme also mentions a circumstance in this syphon-aqueduct, which has given rise to much discussion among those who have examined the subject; he states that these syphon pipes, after having descended about 75 feet, each divided itself into two branches, and that thus the waters are carried the rest of the course over the bridge in eighteen pipes, and until they rise again, on the opposite side, to a height of about 70 feet, at which point they are again united, and the waters pass on, and enter the receiving reservoir in *nine pipes*.

In opposition to this opinion of Delorme, another eminent architect, who examined the aqueduct, thought that the receiving and emitting reservoirs had the same number of pipes; and that the nine pipes which proceeded from the one to the other, preserved the same dimension throughout.

Delorme also says, that the water in the emitting reservoir, was higher by 1 foot than that in the receiving one; but M. Villar, a man of science resident at Lyon, took the level and found, as might have been expected, that the water in the receiving reservoir was higher by at least 12 inches than that in the emitting reservoir.

To construct these individual aqueducts, says another architect, the Roman architects began by forming a trench 5 feet wide, and 10 feet deep, having a uniform slope of one foot (Fr.) for a hundred toises. In this trench they formed the aqueduct or water channel of masonry, keeping the same dimensions in the parts excavated from the rock, as in those which were cut into the clay or gravel soil.

The bottom of this trench was laid with masonry, a foot (Fr.) thick; on this, two walls were erected, each 1½ feet thick, and 5 feet high, and leaving a space between them of 2 feet, which formed the canal for the passage of the water; this space was enclosed on the top by a semicircular arch a foot thick, and then covered with a layer 2 feet thick of earth. The bottom of the canal had a coat of cement 6 inches thick, and a coat of 1½ inches on the sides, which reduced the intervals between the walls to 21 inches. The angles were formed by the sides and bottom rounded by cement. The walls were constructed with small rough stones, from 3 to 6 inches in thickness, laid in a bed of mortar, so that no void was left between the pieces. It would appear that the use of stones larger than 6 inches was avoided, as the walls formed of small stones, well bedded in mortar, formed, in the estimation of the ancient Lyonese architects, masses of greater compactness, than those built with larger pieces.

The builders also used gravelly sand for this kind of masonry in preference to fine sand, which is proper only for the cement; and when they were obliged to use the finer sand, they took care to mix it with pulverized bricks, a practice adopted also in cases where coarse sand was mixed in abundance: lime burnt from good stones was used with unsparing profusion.

The cement employed for the sides and bottom of the aqueduct was composed of pieces of brick the size of peas for the first coats, and somewhat finer for the finishing plaster. That on the bottom of the canal is made of pieces as large as nuts, and in many places the size of eggs; the composition was made with lime fresh slaked. That which contributed to make good cement, as well as good mortar, in their opinion, both in the one and the other was the effectual mixing of the ingredients, so as that the mass should be all of the *same temper*, which is known when the composition was of the *same colour throughout*.

In the aqueducts not built in the earth, the walls are from 22 to 24 inches thick, the exterior faces formed of reticulated work, the lozenges being from 3 to 6 inches square, without any course of bricks. The arch of the water channel, where it was not covered with earth, was somewhat curved to throw off the rain, but yet so flat as to serve for a road of communication between the reservoirs, and within the aqueduct, and which was entered through iron doors placed in the arch of the reservoir, and also in that of the one or two places of the arch channel aqueduct bridge. The subterranean channels had similar entrances like square pits, the mouths of which were elevated 2 or 3 feet above the surface of the ground they were driven into.

The entrance of the water into the aqueduct was regulated by a vane, or sliding valve of a certain dimension, as only a certain quantity was allowed to flow into each branch. This does not appear ever to have exceeded 21 inches of elevation, which was sufficient to fill all the syphons; without this precaution the volume of water, which might have risen to 4 feet, would have been too great. It is probable that the regulating vane or sluice could be raised or lowered at pleasure to allow for the increase of head, and that the superfluous quantity was at times permitted to flow into some other channel.

Where the aqueduct was carried above ground, it was built on a footing of masonry 6 feet thick, even where the elevation above the surface did not exceed 6 or 7 feet; but when it was greater, arches were formed, and also piers, when the elevation was considerable; on this elevation depended the span of the arches, the thickness of the piers, and their height. For an opening of 18 feet in height the width is 12 feet, and the piers 6 feet, sustaining a semicircular arch; when the inequality of the surface did not allow the piers to have an equal height of 18 feet to each opening, the piers were shortened, and the other parts remained of the same general dimensions. The piers of the arches in some places are rather less on the face than 6 feet, varying from 5 feet 8 inches to 6 feet; and in other cases they are 7 feet 9 inches. The arcade which conducts the water into the reservoir called St. Irenee, is 31 feet high, its width is the half of this, and the faces of the piers are 7 feet 9 inches. As the upper part containing the canal is only 6 feet thick, there is an offset of 6 inches on each face at the impost of the arches. (See engraving of "Aqueduct at Lyon," fig. 1.) On this offset there is a projection, or pilaster, 10 inches thick, and 3 feet wide, which acts as a counterfort, to strengthen the sides of the water channel.

The foundations of the piers having the smallest elevation are sunk between 3 and 4 feet below the surface of the ground, and between 6 and 8 feet for those of the greatest height.

All the different supports of the aqueduct are of the same kind of masonry, formed of small rough squared stones, laid in a thick bed of mortar, with the apparent faces of reticulated work. This kind of masonry was bound at every 4 feet of its height by two courses of "great bricks," each brick being 22 inches square, and 2 inches thick. The angles of the piers formed of small square slabs of stone offered, in many instances, an insufficient resistance to the lozenge masses which they terminated, and their displacement has been apparently the main cause of the ruin of the greater number of the piers; for these have been formed by a sort of encasements of the thicknesses of 4 feet of the opus reticulatum, without being properly bonded by stones large enough at the quoins. The arches are semicircular, the arch-stones are slabs (thick slates) of stone, 3 inches thick, alternating with a "great brick;" the extrados of the arch is finished by a row of bricks, which forms a fillet. On this fillet is laid a double horizontal row of bricks, which runs through the entire length of the aqueduct, without, however, forming any projection. It is upon these bricks, as a pavement, that the water channel is laid or bedded.

Of the arcades forming that part of the aqueduct called Langoneau, only seven piers remain, and these of the common reticulated masonry. The valley between Soucieu and Chaponost is about 200 feet deep. Five ranges of arcades, placed one over the other for a length of 400 toises, conducted the water across the valley; the valley through which the river D'Izeron flows, between Chaponost and St. Foi, is nearly 300 feet deep, and was crossed by a series of arcades having eight ranges in height. The third valley, formed by the small hill of St. Foi and that of Fourvieres, had three ranges of arcades.

These prodigious substructions must have occasioned an outlay so enormous, as under almost any circumstances would have completely arrested the completion of the undertaking; and the more so, as these vallies were neither all, nor the greatest, across which the water had to be conducted. The resources of the architects here become conspicuous in their substitution of leaden pipes forming syphons already described, which were laid at an expense comparatively trifling to what must have been incurred by following the other, and more usual method.

In describing the passage of the valley of the Garon, the aqueduct arriving at the summit of the hill, was stated to deliver its water into a tank or reservoir placed in a square tower.

This reservoir, 14 feet long by 4½ feet wide, is 7 feet high to the summit of its arch; the walls are 4½ feet high to the springing of the arch, and 2 feet 3 inches thick. The arch is pierced in the centre by an opening 2 feet square, which serves as a passage into the reservoir. The bottom is lined with a coat of cement 6 inches thick, with a curve at the angles of concourse of the sides and bottom; there were two ranges of iron rods about ½ inch in diameter, to strengthen the walls, and probably also to serve as a kind of stair by which to descend into the reservoir.

This syphon bridge (see engraving) is disposed in the same manner, and has the same proportions as the other arcades; the width of the arches being 18 feet, and the height of their opening 36 feet; but this part is somewhat different from the others from its width, which is 24 feet, and by its piers apparently terminating at the impost or springing of the arches, forming an elevation of considerable elegance, and a *covered passage* under the bridge. The arcades pierced in the piers for this road or gallery, are 4 feet wide, and 21 feet high, their arches being formed of voussoirs of thin stone, alternating with great bricks; the facing is of reticulated masonry, and being built with black and grey pieces, has much the appearance of a chess board. However, these openings having weakened too much the higher piers, the builders were under the necessity of strengthening some of them by counterforts of the same sort of masonry. Two arcades in the valley of Baunau fell in 1757, from this precaution not having been taken; from these piers, after their fall, it was observed that the arches were divided into compartments in their depth by voussoirs formed of a double row of great bricks.

The quantity of water, according to Delorme, which was furnished by this aqueduct in twenty-four hours, was 1,323,000 cubic feet. (Fr.) This author, however, did not appear to have made any corrections for the diminution of velocity on account of friction, and other circumstances affecting the motion of fluids; after these have been made to bear on his calculation, the quantity has been estimated as not being greater than about 172,800 cubic feet.

The receiving reservoir for the valley of Baunau is 18 feet long, and 6 feet wide. It was pierced, according to Delorme, with twelve openings for as many syphons; this increase in the number of pipes being made on account of the valley being deeper than that of the Garon; and, as he thinks, that as the pressure increases, while the depth is augmented, that the architects multiplied the number of syphons to divide this force by diminishing their diameter in proportion. A circumstance which, if accurate, would clearly decide that the difference between the *weight* and the *pressure* of water was unknown to the Roman architect. The rest of the syphon bridges are similar to that of the Garon. There is now no vestige of the emitting reservoir of St. Foi. The receiving reservoir of St. Irenee is also much dilapidated, and also that of Soucieu. Delorme conjectured that its side was pierced for a smaller number of syphons than that of Soucieu; but these pipes were of a greater diameter than those of the others, as appears by the parts at present in existence; and Delorme thinks that the emitting reservoir was like the receiving tanks which are seen near the wall of the city of Lyon, and conducted the water by an aqueduct to the reservoir now called the Maison Angelique. This reservoir was also furnished with the usual opening. Delorme further observed, that the emitting reservoirs had an opening at a height of 4½ feet above the level of the pavement, to turn, if required, the flowing water to the bottom of the tower, and to facilitate their cleanings and reparations.

The great reservoir of the Maison Angelique, the bottom of which is now buried in the ground, was supported by a series of vaults separated by partition walls 2½ feet thick. Five of these vaults are still entire. They are semicircular, built of small rough squared stones, with courses of bricks in the voussoirs in each 10½ inches; and they appear to have been laid without mortar. A fall or step of 1½ feet, arched to a height of 4 feet, is still seen in a wall 7½ feet thick. The water here descended by a well or tank 1½ feet square, which joins the south side, where it has a thickness of more than 10 feet.

Decolonia (in his Histoire Littéraire de la Ville de Lyon,) says, that thirty leaden pipes, of from 15 to 20 feet in length, marked by the initials TI.CL.CAES.(Tiberius Claudius Cæsar,) were found in this part. He had no knowledge of the reservoir discovered by Delorme, to which it is probable these pipes belonged, and in which they were used for distributing the water to the buildings and gardens of the palace of the emperor Claudius.

The fig. 1, in the engravings marked "Aqueduct of Lyon," is an elevation of one of the syphon bridges. Fig. 2, its plan. Fig. 3, part of one of the arcades on a larger scale. Fig. 4, an exterior view of the perforations in the reservoir for the syphon pipes. Fig. 5, the plan of the reservoir; and fig. 6. its section; and fig. 7, a section of one of the ancient lead pipes, showing the thickness of the stony incrustation on the inside. A, is the solder which secured the joint.

The *Aqueduct at Metz* was also built by the Romans when this city was included in their dominion; but it is impossible to decide what epoch should be assigned for its erection. We read in the "History of the City of Metz," that the Roman legions were expelled from it, about the year of Christ 70. As the retreat of the Romans was succeeded by troubled and hostile periods, it appears probable that the date of the construction of the aqueduct, as well as that of the other grand buildings of the Romans in this neighbourhood, reached to a remote period—probably that of the reign of the first emperors—perhaps to that period when the legions of Cæsar held possession of Gaul.

The chief water which this aqueduct conducted into Metz, was taken from the valley above Gorze, now named les Bouillons. It is conjectured that the waters of the valley were collected into a basin, from which it flowed into the aqueduct in this spot constructed under ground.

The water channel in general was 6 feet deep, and 3 wide, and laid on a course of masonry of small unhewn stones laid in a bed of mortar. Its thickness was proportioned to the solidity of the ground over which it was carried. In those parts where the bottom was considered to be sound and firm, it was not made more than a foot thick. The inner faces of the walls forming the water channel, were built of small wrought stones, nearly of the same size, and placed in regular courses. These stones were about 7 or 8 inches on the side, and 3 inches high in front, and about a foot long. Those on the outer face were rough chiselled. The wall on the side of the mountain had a greater or less thickness, as it had to support a greater or less thrust of the earth. In portions of it where this thrust was trifling, its thickness varied from 1 to 2 feet. The arch which encloses the water channel was semicircular. The voussoirs were about a foot square in the joints, and 2 inches thick towards the intrados, and three inches at the extrados. The arch was covered with a course of common rough masonry 7 or 8 inches thick. To prevent the percolation of the water into the piers or substructure, the inside was lined with cement 2 inches thick on the sides, and 3 inches on the bottom.

The water channel is still preserved entire between the "Moulin de Gorze" and that town, passing under the houses forming its principal street for a length of 150 toises. At leaving Gorze, its direction is along the top of a hill, until it meets the highway to Metz, a distance of 350 toises. From that, to procure a uniform slope, the Roman architect was obliged to follow the windings of a small valley for 483 toises. Here it was conducted across by a small aqueduct bridge. After making another quick bend, it keeps the slope of another part of the hill, occasionally appearing above the surface. Here are traced the remains of a fountain, which is supposed to have collected some subsidiary stream; its further course till it reaches Metz, is somewhat more direct.

In following its course for 6,286 toises, (the distance between its summit, and where it meets the river Moselle,) it has a fall of 29 feet 6 inches, which gives a declivity of two-thirds of a line for each toise of length. At the extremity of the aqueduct is a cistern, (fig. 1, on engraving marked "Aqueduct of Metz,") 28½ feet long, by 21½ wide, into which the water is conducted from the water channel. The part BED is backed by the mountain, and forms an arc of a circle of which the cord is 21½, and the sine 7½ feet. The opposite side is square. The walls are 3½ feet thick on the sides BC, and 3 feet on the other parts. They are built of small stones laid in mortar mixed with cement. The outside and inside faces are of stones of the same size, but roughly wrought on their faces and beds, and laid in regular courses; the inside face having a coat of cement about half an inch thick.

In the centre of the reservoir is a basin 14 feet long, by 9½ feet wide, and 1 foot deep, surrounded by a banquette 6 feet broad on three sides, and 9 feet broad on the other. This banquette is formed with large wrought stones, and finished towards the basin by triangular bricks from 8 to 10 inches on the face, and 6 inches at the end.

In the centre of the circular part of the reservoir is placed the opening of the aqueduct. Its height from the under side of the arch to the bottom is 5 feet 8 inches, and 3 feet wide. At a height of about 8 feet in the angle, is another opening of a canal of discharge, 5 feet 1 inch by 2 feet 10 inches. It forms an angle with the wall of about 80°.

On the side opposite to the circular wall of the reservoir, and rising from the bottom of the basin, is this wall, dividing the water channel through the length of the bridge, about 12 inches thick. This wall would appear to have been entirely composed of triangular bricks, coated on two sides with cement an inch in thickness. The water channels are not quite equal, one being 2 feet 8 inches wide, and the other 2 feet 4 inches. The reservoir was probably covered by an arch, having voussoirs of stone placed in the herring-bone fashion, the upper ends of which were about 4 feet square. The intrados was coated with a thickness of 3 inches of cement, and painted in fresco. On the outside it was covered with a roof, constructed with two sorts of tiles; those now called *antique tiles*, made flat with ledges, and the others circular, to cover the joints of the former.

Part of a base of a column, in which was a niche containing a figure much mutilated, was found near this spot, which is conjectured to have been a nymph—probably that to which the water was dedicated, and placed in the reservoir.

The basin in the bottom of the reservoir is supposed to have been formed for the purpose of preventing the greater part of the sediment of the water which might be deposited, from finding its way into the aqueduct; and that it was withdrawn from this part from time to time, as it accumulated.

The remains on the side of Ars, approaching the Moselle, are much more dilapidated than that part on the other side, near the village of Jouy. At some distance from the reservoir are two arches much ruined; a little further on a part of a pier and five arches. The remains at Jouy consist of seventeen arches. The first seven are entire: the remainder are more dilapidated. This bridge, joining the two mountains, separated by a valley of 560 toises, had a declivity of 12 feet, 10 inches, and 7 lines, which gives a fall of nearly 3 lines for each toise in length. The channel at the top was 10 feet 10 inches wide, divided, as has been already stated, by a wall of triangular bricks 18 inches thick, (see figure 7 in Metz aqueduct;) thus forming a double canal, apparently for the purpose of allowing the water to flow into one, while the other might be repairing.

All the inside work is of common small stones bedded in mortar. The facing stones are wrought in their beds, and chiselled on their faces, placed in regular courses: the one 3 and 4 inches high alternately. All the arches are of the same construction, and of the same proportions. The opening of the one on the side of Jouy is 57 feet high, the diameter of the arch 17½ feet, and each face of its pier 14 feet.

The prodigious height to which these arcades must have been carried, if the aqueduct bridge consisted of only one range of arcades, has given rise to an opinion, that it was composed of two ranges of arcades, like the Pont du Garde.

At the extremity of this bridge on the side of Jouy, a second reservoir was found, constructed in a very different manner from that shown in the former figures. It is completely circular, forming a kind of well, having a diameter 12¼ feet. The outside walls are 3 feet thick. In the middle is a basin 6¼ feet in diameter, having a banquette, 3 feet broad, and 4 feet 10 inches in height, running round it. This banquette is built of squared masonry, to a height of 4 feet 10 inches above the bottom of the basin. The remaining height is of the usual masonry, coated with cement 2 inches thick. The double water-duct is formed by dividing the channel by an 18-inch wall, as in the other reservoir. The bottom of both of the channels is 1 foot 4 inches above the bottom of the basin. The height of the arch is 5 feet 6 inches, and the channels are coated in the inside with cement to the height of 2¼ feet. In the upper part of the banquette, opposite the openings into the aqueduct, is another banquette, 1 foot 9 inches deep, and 13 inches broad. It is conjectured to have conducted some neighbouring stream into the reservoir. Its sides and bottom are coated with cement 2 inches thick. The water-duct, through which the water flows to the city of Metz, is 5 feet 3 inches high, and 3 feet 2 inches wide: its pavement is not more than 9 inches above the level of the banquette. Opposite to this passage is another, by which to descend into the reservoir. See fig. 5, which is a plan, and fig. 6, which is a section of this reservoir.

The total length of this aqueduct, reckoning from the "Moulin de Gorze" to its point of distribution, is 11,373 toises. The total declivity is 68 feet $5\frac{2}{3}$ inches, giving a fall of nearly $\frac{7}{8}$ of a line for each toise in length.

It is thought that the aqueduct was carried along the summit of the hill on which the citadel was placed, and that there it flowed into a cistern, from which it was distributed according to the mode in use among the Romans. A part being appropriated for the supply of the public fountains, another for the baths, and a third portion was conducted into the houses of individuals, who paid a certain rate, which was devoted to the repair of the aqueduct.

M. Lebrun made some experiments to ascertain the velocity of water in this channel, the mean of which gave a current flowing 156 feet 8 inches each minute: and he estimated that 1,067½ cubic feet of water were furnished every minute. Another series of experiments, made by the same military architect, when the stream was much reduced by the great drought of the preceding summer, gave 684 cubic feet per minute.—The mean of the two is nearly 876 feet, equal to 1,259,000 cubic feet each day, a quantity sufficient for the supply of a much greater population than we can imagine ever to have been collected at Metz.

The *Aqueduct at Evora* was among the public buildings raised by Quintus Sertorius, when he made himself master of this district about eighty years before Christ. It is still in excellent preservation, and the piers are 9 feet broad by 4½ feet thick; the arched space is 13½ feet wide, being equal to the breadth and thickness of the pier added together: at intervals, buttresses are superadded to the piers, "the better to secure the arcuation.' The whole is formed of irregular stone, except the arches, which are of brick.

The castellum is the most perfect of the kind existing, and remarkable for its fine proportions, and elegant decoration; its plan is circular, and its greater diameter 12½ feet, independent of the surrounding columns, which are eight in number, of the ionic order. In each intercolumniation is a niche with a striated or conchal head, and an aperture is formed in one of them to give access to the inside of the structure. The second story is decorated with ionic pilasters, between which are apertures for ventilation; the top is crowned with a hemispherical dome. In the centre of the building is a small reservoir, from whence tubes were conveyed to the different fountains and cisterns.

The acroteria and depressed parapet of this monument, are singular deviations from the usual employment of these members. It is probable that each acroterium was formerly crowned with a vase, the remains of one being still visible; and from the fragment of a pedestal, to be seen in one of the niches, it is probable either a statue or a vase decorated each aperture.

The whole is constructed of brick, incrusted with cement of so hard and durable a substance, that few parts of it appear to have failed by the natural decay through age; and considering that it was built seventy years before the Christian era, it may be considered one of the most interesting monuments of Roman art in existence. See *Castellum.*

The Aqueduct at Carthage, constructed by the Carthaginians during their prosperity, was conducted for a length of seventy miles, over mountains, and through vallies; considerable remains of it are still seen. Near Udena, there is an arcade consisting of above a thousand arches, where it had been conveyed across a valley; some of these arches in the middle of the valley are above 100 feet high. In building this work, they made use of a strong cement, which is as durable as the stones themselves, though these are of a harder nature than our English limestone of a yellow colour. The water channel is coated with cement of such extraordinary tenacity, that in some places, flakes of it have fallen from the wall in lengths of upwards of 100 feet, yet still adhering together; the conduit is 6 feet high within, and 4 feet wide, *arched to a point.*

At Ariana, a village four miles from Tunis, other remains of this structure are found, but not in quite so perfect a condition; where the channel was conveyed through a mountain, at every sixty yards, vertical tunnels have been made from the channel to the surface of the mountain; these are 4 feet in diameter, and very neatly walled with hewn stone, and the wall is continued to a height of 4 feet above the surface, and to prevent any thing falling in, the stones are very neatly rounded at top. The masonry of the aqueduct throughout is of beautiful execution, and in some places still remains as perfect as when it was erected; from some marks, it is conjectured that a part of it had been repaired by the Romans.

A *subterraneous aqueduct* surrounds the town of Morocco, 20 feet below the surface, and from which, at every hundred yards, pipes of brick-work branch off, and convey the water into the wells of the different houses. Over each of these branches are excavations from the surface, through which persons descend to repair any injuries below: this aqueduct is now much out of repair, and neglected.

The Aqueduct at Bourgas. There remains in the valley of Bourgas, near Constantinople, three aqueducts, which conduct the water destined for the supply of that capital. The most remarkable, as well for its fine proportions as for the solidity of its construction, is traditionally asserted on the spot to have been built during the reign of the emperor Justinian.

This aqueduct bridge traverses a strait and deep valley. Its height is about 108 feet at its base. Its length does not exceed 70 toises or 420 feet; but at the level of the water channel it is nearly 120 toises.

The part forming the centre of the aqueduct is composed of two stages or ranges of arcades, each of four great pointed or gothic arches. Those of the lower range are 8 toises and 4 feet in diameter, and 7¼ toises high: the arches of the second range are narrower, their width not exceeding 6¼ toises, and 6 toises and 1 foot high. The piers separating the lower arches are 6¼ toises on the face. Those forming the lower series are pierced at a height a little above the impost of the arches, by small arcades 1 toise and 5 feet wide; the piers of the second range having similar openings placed over those of the lower range, 2½ toises wide.

In the elevation, the piers are strengthened by counterforts on a triangular basis, so as to form a salient angle or bec. These are further scarfed in their height so as to terminate on the face of the wall on each range, and to reduce the thickness of the wall to 3 feet 6 inches instead of 3 toises.

Above the first range of arcades the aqueduct is formed throughout its length into a passage, having an opening of 4 feet, which serves as a gallery of communication between one side of the valley and the other. This is connected to the roads by stairs or inclined planes, which terminate the inner passage at both ends. The aqueduct is prolonged to the right and left by small arcades, which carry the water along the crest of the eminences.

In the engravings marked "Aqueduct at Constantinople," fig. 1 is an elevation of the aqueduct at Bourgas. Fig. A, part of the same on a larger scale, is a section of the bridge through the key-stone of the large arches; and fig. B, is a section through the key-stones of the small arches formed in the piers.

Near Santa Maura, in the Ionian islands, there are remains of an aqueduct of 2½ feet wide, and nearly a mile long, from which it was conducted by earthen pipes into the fortress. It is traditionally ascribed to Bajazet: it is now applied to the purpose of a bridge.

The *Aqueduct of Spoletto* was built about the year 741 by Theodoric, king of the Goths, to form a communication with Spoletto, which stands on the top of a mountain. It is formed of ten grand arches, each 66 feet 10¾ inches diameter, supported on piers 10 feet thick; the middle arches, under which flow the rivulet of Maragia, are about 308 feet high; about the bridge is the aqueduct for supplying Spoletto with water. This monument is admirable from the skill shown in its construction, and the boldness of its design. It is built of a very hard and durable stone, and is now in excellent preservation: its length is 671½ feet, and its width 41 feet. It may also be given as an instance of the use of pointed arches nearly five hundred years before their appearance in English building, and which, in lightness of proportion, exceeds any example of gothic building which could be pointed out in the most delicate tabernacle work of the highest and most florid period of the gothic style. It is further remarkable as an instance of pointed arches constructed by the *Goths*, who have been considered, by many antiquaries, to have no claim to their invention, or even to their use. See *Gothic Architecture.*

The prince Biscari's Aqueduct in Sicily, was constructed at the sole expense of a nobleman of that name, over the river St. Paul. The aqueduct, which conveys a salubrious water into the domains of this family, also serves as a road across the valley. It is composed of thirty-one arcades; the largest one is formed in the gothic manner, 84 feet wide, or 120 Sicilian palins, under which passes the river.

The length of the bridge is nearly 254 feet long, and its height 112 feet; the passage, or road, is formed on the top of the first row of arches, and the waterduct is placed on the upper tier.

The *Aqueduct of Segovia* contains one hundred and fifty-nine arches, and extends about 740 yards; where it crosses the valley it is somewhat more than 94 feet high. The city is built upon two hills, and in the valley which separates them, a great part of the inhabitants would be deprived of water but for this edifice. This boon was conferred, according to the local antiquaries, by Trajan, who erected the aqueduct, and which is still in excellent preservation. Upon a level at its origin with the rivulet which it receives, and supported at first by a single stage of arcades, which are not more than three feet high, it proceeds to the summit of a hill at the other extremity of the city, and gradually increases in height in proportion to the declivity of the ground. In its highest part, a bridge has been thrown across an abyss. It has two branches, which form an obtuse angle with the city.

At the commencement of this angle, it becomes a grand object—its two rows of arcades rise majestically above each other, and the spectator is surprised at its gigantic height with the lightness of its piers. It has stood sixteen hundred years, and its solidity seems inexplicable, when the simplicity of its construction is more closely examined. It is built of square stones, laid in courses, without external appearance of mortar; and some of its arches are built in the pointed form. Probably these have undergone repair, either by the Goths or Moors, when they had possession of the country. "Miserable modern houses are fixed against some of the pillars of the aqueduct, seeking a support in these proud remains for their own weakness, and degrade the monument which supports them. A small convent, exhibiting some pitiful architecture, is placed at the angle formed by its two branches."

The *Aqueduct of Los Canos de Carmona* conveys water from a hill where it rises in springs near the town of Alcala, at a distance of about eight miles from Seville. It is a matter of dispute whether this be a Roman or Spanish-Arabian work, but to an accurate observer, it appeared to contain a mixture of both styles; probably originally constructed by the Romans, and afterwards, as the works decayed, repaired by the Moors. The arches composing it are of a different construction, some resembling the Roman, and some the Moorish, which last approach to the horse-shoe form, and terminate within the perpendicular that supports them. The arches are 12 feet in diameter, and the arched opening 30 feet high. These varying in height according to the level of the ground over which the aqueduct is carried, the water is conducted in an open canal on the top of the arches. and forms a constant stream 3 feet wide, and 2 feet deep, and is esteemed excellent. A part of it is received into a large reservoir near the gate, and the remainder is conveyed by pipes to the Alcazer, public fountains, and the houses of individuals. The entire length of the aqueduct is composed of brick and mortar. Remains of a similar erection of great extent are still existing near Toledo.

Many of the arcnes of the aqueduct which conveyed water to the ancient city of Acipinio, are also remaining near old Ronda, without any mixture of Moorish additions. They are about 16 feet in diameter, and 28 feet high, and the water channel was formed on the top. The reservoir at Ronda under the Dominican convent was supplied with its water by the aqueduct. The reservoir is on a level with the Guadiaro. It is descended by means of three hundred aad fifty steps. The cavern is hollowed into spacious saloons, the roofs of which are formed into domes of prodigious height; formerly the whole was filled with water. There having been no necessity of late years to resort to this resource, the caverns are neglected, and are going so fast to decay, that, in a few years, they will be filled with the rubbish which falls from the roofs.

The *Aqueduct of Tarragona* brings water to the city from a distance of seven leagues, and in its route traverses a deep ravine, which is 700 feet wide, and 100 feet high.—The aqueduct bridge has two ranges of arcades, the lowest consisting of eleven arches, and the upper of twenty-five. It is not considered to be of a higher era than that of the occupation of the country by the Moors.

The *Aqueduct in the Plain of Anover*, formed by Philip V., is seven leagues long: it derives its water from the river Jamara, and was constructed for the purpose of irrigation. Within the last thirty years it has been suffered to fall into decay, and is now so ruined as to have become useless.

The *Aqueduct of Almasora* conducts water, for the same purpose as that of Anover, into the plain of Castellon, from the river Mijures. It is a tunnel, almost the whole distance from S. Quieteria to Almasora, cut through a limestone rock. Its formation has been attributed to the Romans and Carthaginians, and to the Moors; but the opinion of an able Spanish antiquary, assigns it with great probability to a later period; it having been, in his opinion, constructed by Jayme el Conquistador, about A.D. 1240. "In comparison with this magnificent work, how contemptible is the Mountain Percée, in Languedoc, for which Louis XIV. received so much fulsome adulation!"

In many other parts of Spain, especially the southern provinces, are found numerous fountains and reservoirs of water, covered with arches, and conducted in channels to distant points, as well for the supply of the inhabitants as for irrigation, attributed to the patient industry of the Morescoes, when, with equal probability, they might be ascribed to the Romans—to the Carthaginians—or to the more ancient inhabitants of the Peninsula.

The *Aqueduct of Lisbon* has been long admired for the excellence of its construction, and, in point of magnitude, is not inferior to any similar edifice which the ancients have left us. That part of it situated in the valley of Alcantara, about a mile from Lisbon, consists of thirty-five arches, by which the water is conveyed over a deep vale formed by two opposite mountains. The dimensions of it in the deepest part of the valley are as follows: height of the arch from the ground to the intrados, 230 feet 10 inches; from the vortex of the arch to the extrados, exclusive of the parapet, 9 feet 8 inches; from the extrados to the top of the ventilator, 23 feet 4 inches; making a total height from the ground of 263 feet.

Span of the principal arch 107 feet 8 inches; breadth of piers of the principal arch 28 feet; and thickness of the piers in general 23 feet 8 inches.

The arches on each side of the principal one diminish in breadth as the piers, whereon they rest, decrease in height with the declivity of the ground; they do not, however, decrease by any regular progression, neither are the curves employed in the arches of one kind; fourteen of them being in the gothic, or pointed style, the rest are semicircular; a variation adopted by the architect, Manuel dal Maga, from an apprehension, that making the five principal arches semicircular, he would considerably add to the expense. In the rest of the edifice much judgment has been displayed; no part of it has failed, or appears to have reeeived the least injury from earthquakes.

Over the arches there runs a vaulted corridor 9 feet 6 inches high, by 5 feet broad internally. A continued passage runs through the centre of it, for the people who constantly attend to keep it in order, and a semicircular channel, or conduit of 13 inches diameter, at each side, through which the water is conveyed. It is worthy of remark, that these channels are laid, not in an inclined direction, as in other aqueducts, but horizontally; to compensate for this, a small depression is made at certain intervals, by which the water is impelled along the horizontal line; a manner supposed by the natives to require less declension in conveying water, than an inclined line. There are two thoroughfares for foot passengers along the aqueduct, one at each side of the corridor, which is 5 feet wide, defended by a stone parapet. From some remains of the Romans on this spot, it is supposed they either had, or attempted to construct, an aqueduct in this situation.

The *modern Romans* are partly indebted for their profuse supply of water to the magnificence of their renowned ancestors. During the anarchy of the middle ages, when the most estimable works of antiquity were dilapidated by the wantonness of barbarians, the aqueducts did not escape the general destruction; and Rome which a few centuries before had rivers of water flowing in her streets, drew her supply from unwholesome springs, or marshes. A precarious supply had at times been occasionally derived by repairing an ancient conduit, but neither the resources of the state, nor the skill of individuals, were equal to the undertaking of a permanent reparation. It was not until the pontificate of Nicolas V., that a restoration of an ancient aqueduct was attempted: the Aqua Appia was then begun, and the work continued by Sextus IV. was completed by Pius IV. in 1568.

At this period the three channels by which water of the restored conduit arrived at Rome, were conducted into, and distributed from, a reservoir without any architectural ornaments. Clement XII. began its decoration on the side of the modern Palais Conti from the designs of Nicolo Salvi. This beautiful monument and masterpiece of its author was finished under Benedict XIV. and received the name of Trevi, from the water being conducted into its basin by three channels, and also from its position at the meeting of three streets. Of the three modern aqueducts the Aqua Virgine is accounted the most salubrious, and best adapted for culinary purposes. The pipes of this water are, on this account, sold at a higher price than the others, by the apostolic characters.

The aqueduct which furnished in the time of Frontinus 2,504

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quinaires, now furnishes nearly 65,782 cubic metres in twenty-four hours, and this quantity is distributed by seven principal conduits into thirteen public and thirty-seven common fountains.

The present *Aqua Felice* is part of the water of the ancient Aqua Claudia and Aqua Marcia, united with some other springs collected under the pontificate of Sextus V. The stream begins from the Campo Colonna, situated to the left of the Palestrina road, fourteen Roman miles from Rome, and enters the city through that remarkable ancient remain, called the monument of the Aqua Claudia. This water follows a course approaching to that of the Aqua Marcia and Aqua Claudia, but is on a lower level than either, as its sources are not so high up the Anio. All the waters of which the Aqua Felice is composed, were united by Urban VII. in one immense reservoir, and several smaller ones, whence they were conducted into the conduit by an aperture named *fistola urbana*, formed in a block of marble. According to Fontana this stream is equal to a hundred superficial "onces d'eau."

The quantity of water has been estimated at 20,537 cubic metres in twenty-four hours, distributed in sixteen public, and eleven common fountains.

The fountain from which its water is distributed to the city, is adorned with a statue of Moses striking the rock, and two other figures with four ionic columns of granite, and two Egyptian lions of basalt, which formed part of the ancient decoration of the Pantheon. Its name Felice, is derived from Felice Peretti, which was that of the family of Sextus V.

The *Aqua Paola*. In 1694, the cardinal Orsini having proposed to the papal government to bring water from the lake Bracciano (anciently Alsietinus) to Rome, in the ancient channel of the Aqua Alsietina, the architect Paglia examined the levels, and stated that a sufficient quantity of water could be obtained and directed into the channel as projected by the cardinal. Permission was accordingly given to the Orsini family to commence operations, on condition of furnishing about a third part of the water for the supply of one of the new public fountains, and dividing with the apostolic chamber the revenue which would arise from the disposal of the remainder.

The cavalier Bernini having the direction of the new fountain before St. Peter's, and wishing to ascertain by means which appeared to him less exceptionable than those employed by Abbe Paglia, whether the quantity which had been stated, as being at his disposal, could be obtained, or depended upon, committed the examination of the levels to his brother, who gave his opinion against the practicability of obtaining that quantity which the cardinal anticipated, on account of the small declivity of the channel of the aqueduct, and the variations in the level of the lake itself. The pope having directed new experiments and observations to be made, it was found that although the level of the lake was about 1½ palms above the surface of the ancient reservoir which fed the aqueduct, that this additional head was insufficient to produce the velocity to furnish the supply which was considered to be desirable. To obtain this velocity a weir or dam was erected across the mouth of the lake to preserve its waters at the proper height, and the usual means of regulating the head, and disposing, of the superfluous water by sluices, was resorted to. The aqueduct now received the name of Aqua Paola, from the name of the pontiff, (Paul V.) in whose reign it was brought to Rome.

The quantity of water furnished by this aqueduct is estimated at about 94,184 cubic metres in twenty-four hours.

Thus, from the three modern aqueducts, not less than 180,500 cubic metres of water are daily introduced into Rome; yet the want of cleanliness is remarkable in every street and corner of the city. The water is not conveyed by pipes into the upper floors of houses, but into a common fountain in their courts. In order to raise it to these stories, a strong iron wire is fixed with one end above the fountain, and another above the window; a bucket is made to slide along this wire, having a rope attached to it by which it is let down into the fountain, and passed over a pulley above the window; the end of the rope is held by the person in the window, and when the bucket is filled, he draws the rope and it slides along the wire as a guide until it arrives at the window, where it is disengaged by the attendant.

The *Aqueduct of Caserta*, one of the most magnificent modern works of the kind in Europe, was commenced in 1753, by order of the king of Naples, to bring water from some springs at a distance of nine miles, rising at the base of the mountain Taburno, to the palace which he had recently built at Caserta. These being united with some smaller streams in their route, crossed the river Faenza, on an aqueduct bridge of three arches, and continues its course across the valley of Durazzano by a bridge of nearly the same dimensions; after a short detour, it traverses the deep valley between the mountains Longano and Tifata, by an aqueduct bridge of 1,618 feet long, and 178 feet high, formed of three stages of arcades placed the one over the other. See engraving marked *Aqueduct of Caserta.*

The under range is composed of nineteen arches, the second range has twenty-seven arches, and the third forty-three. The width of the bridge is 20 feet between the outer walls of the arcades; the counterforts project 6 feet. The width of the arches is 20 feet.

Above the first range of arcades the thickness of the wall is 12 feet, and the projection of the counterforts 6 feet. The counterforts rise to the summit of the aqueduct, and on the third story of arcades the intermediate piers are strengthened by pilasters 5 feet 9 inches wide, having a projection of 14 inches. The passage formed in the piers above the first and second ranges of arcades is 4 feet wide. The water channel is 3 feet 8 inches wide, and about 2 feet 5 inches high.

The length of the aqueduct, from the point in which the water is introduced to that where it emerges, is 21,133 toises; the declivity is not more than $\frac{1}{4860}$, of the length about $\frac{18}{100}$, of a line each toise, in place of $1\frac{3}{4}$ line per toise, which is found in Roman works, or about $7\frac{1}{2}$ times less. The architect who *affected* to give so small a slope to the water channel, did not seem to be aware that as the velocity of the current is as the square of its head, or summit level, that in making this $7\frac{1}{2}$ times less, he could only procure the fifty-sixth part of the water, which reduces to a trifling amount the quantity furnished by the magnificent erection.

The reservoir, placed 1,600 toises from the palace, is 400 feet above the level of its court, and is 426 feet 5 inches under the source. If he had given a fall to his water channel of a line each toise, or $\frac{1}{864}$, he would have had in the whole length a fall not more than 147 feet, in place of 26 feet 5 inches; and this declivity would have reduced the height of the reservoir to 279′ feet 5 inches above the level of the court of the palace, a height amply sufficient for all the uses and ornament of the gardens; and he would have had six or seven times more water from the increased velocity given by the additional slope of the water way.

The subterranean constructions are even more considerable than those above ground. Tunnelling has been resorted to five times, the first near the district called *Prato* through the *tuffa*, for 1,100 toises; the second at Ciesco through free stone for 950 toises; the third in the side of the mountain Erose, through rock and earth for a distance of 350 toises; also through rock at Gerzano for 570 toises, and at Caserta, through the mountain, for 230 toises.

To give air and light to these subterranean channels, shafts or vertical funnels 10 feet in diameter at bottom, and 4 feet at top, and many of them 250 feet deep, were sunk from the surface of the ground to that of the aqueduct.

In the engraving marked *Aqueduct of Caserta*, fig. 1, is a general view of the great aqueduct bridge at Caserta; fig. 2, part of the same building on a larger scale; fig. 3, a section on the same scale with fig. 2, and fig. 4, a horizontal section of the same parts.

The *Aqueduct of Castellana* was partly constructed on an ancient Roman road leading to Castellana. This road is about 180 toises long, 5 wide, and its greatest height does not exceed 20 toises. It is perforated in the middle of its length by nine arches, of which three are 13½ toises in diameter, and the other 10 toises at the piers are strengthened by counterforts. The water duct placed above the arches of this ancient bridge, is supported by a range of arcades, of which the entire height is a little less than 8 toises; the perforations are 3 toises wide.

The figure marked *Aqueduct of Castellana*, is an elevation of this building, looking up the stream which flows under it.

The *Aqueduct of Montpelier* is one of the most beautiful works of the kind in France. It conducts the waters of St. Clement, and of Boulidou, to Montpelier. It was designed by M. Pitot, a French architect of great fame, and was completed by him in a period of a little less than thirteen years.

It is formed by two ranges of arcades; the under ranges are 26 feet wide, and 70 in number; the piers 11 feet 4 inches square on their horizontal section. The arches of the second range are smaller, and are so arranged that three of them are contained in the space occupied by the larger ones beneath; their width is 8 feet 5 inches, and their piers 4 feet over the front of the bridge: the greatest height of the aqueduct is 86 feet.

The work is entirely composed with wrought masonry, and at the point of distribution of the water is a reservoir, or *chateau d'eau*, decorated with columns. The quantity of water flowing to Montpelier does not exceed

46,080 cubic feet in twenty-four hours.

The *Aqueduct of Arcueil.* The emperor Julian, having built a palace on the site which is now occupied by the college of Sorbonne, and the hotel de Cluny, constructed an aqueduct 8,000 toises long, to convey to the palace, and the baths which adjoined it, the waters found at the villages of Louan, Montjean, Chilli, Vuissous, and the neighbouring districts.

This aqueduct being greatly dilapidated during the ravages of the Normans, the Roman works were abandoned, and for a period of eight hundred years the waters which they had conveyed were lost to the inhabitants of Paris.

In 1606, during the reign of Henry IV., operations were begun by the direction of the minister Sully, to collect the waters of the plain of Rungis, and for the formation of the necessary water channels and aqueducts: in 1612, these were carried on with vigour, and new levels were laid down for the conveyance of the water to Paris. The works were finished in 1634, but the quantity of water did not exceed 55 square inches. This was but a small portion of the water carried to Paris by the Roman aqueduct; a deficiency occasioned by a grant made by Louis XIV. to a marquis d'Effiat, of the right to the ancient conduits and aqueducts in the plain of Chilli and Vuissous, forming part of the marquisate. In order, therefore, to augment the quantity of water, it was necessary to unite the conduits proceeding from Chilli and Vuissous, with those of the plain of Rungis. Several improvements by some enterprising individuals were made, as well in the original constructions, as in opening some new sources of supply about A.D. 1665. In 1780, an individual named Lucas, observing with regret that the Roman conduits were abandoned as useless, had levels taken of the lands through which they were carried, by which it was demonstrated that the water could still be conveyed into the reservoir in the plain of Rungis: operations were commenced to carry his project into effect, but the work was given up at the commencement of the revolution.

The waters of the present aqueduct are conducted into an arched reservoir, called the Grande Quarre de Rungis, from which they are conducted across the valley d'Arcueil by an aqueduct bridge, and are carried thence to the observatory at Paris by a subterranean channel.

From the reservoir at Rungis to the bridge at Arcueil, is 3,670 toises with a fall of 43 feet 2 lines. At the summit of the bridge is a reservoir which receives the water, and in which they are guaged for the purpose of ascertaining the increase or diminution of the quantity which takes place between Rungis and Arcueil. Proceeding from this, they traverse the valley by the bridge; this to Paris is 2,937 toises with a fall of 11 feet 6 inches, and 3 lines, giving the entire length 6,627 toises, with a fall of 54 feet 6 inches 7 lines. The stream is again guaged in the reservoir at Paris, whence it is distributed in pipes to the public fountains, and to private houses.

Fig. 1, on the engraving marked *Aqueduct of Arcueil*, is an elevation of part of the aqueduct bridge called Arcueil, and by which the water is carried over the valley, between the village of that name, and that of Cachan, The arches are 24 feet wide, and vary in their height by the inequalities of the ground line. Fig. 2, plan of the aqueduct. Fig. 3, section through the middle of the arches, showing the water-duct; a banquette is formed on each side of the channel for walking on. This was the original construction throughout, but as this was in many cases found to be inconvenient, in the restorations which have from time to time been made on the bridge, the banquette is formed in the manner shown in fig. 4. Those parts of the aqueduct formed during the regency of Mary de Medicis, have been constructed with great care, and are still in excellent preservation; these are uniformly of wrought stones.

Aqueduct of Maintenon. In 1680, Vauban and Lahire conceived the project of bringing the waters of the river Eure to Versailles.

The results of levels made to ascertain the altitude of the point of supply gave 110 feet above the level of the marble court of the chateau de Versailles, a distance of nearly 60,000 toises. The works commenced in 1684, were interrupted four years afterwards. The first portion of the length was about 24,000 toises from the point of supply to the aqueduct de Maintenon, and was carried along the surface of the ground; in this distance it was to be carried across five vallies. The second portion was the aqueduct de Maintenon, constructed of masonry, 23,000 toises long. The bridge had three ranges of arcades, the lowest range consisting of forty-seven arches, stretching in length to 500 toises, the second story was composed of one hundred and ninety-five arches, stretching 2,070 toises: the third range had three hundred and ninety arches in length of 2,070 toises; its greatest height would have been 220 feet. The third part of the aqueduct from the bridge of Maintenon, to l'Etang de la Tour, was 13,875 toises. The water channel was formed in this length of different embankments of earth, varying in its height with the ground over which it was carried from l'Etang de la Tour, to the reservoirs constructed on the height of Satovy: it was to be carried in trenches, or by subterranean work, with a fall of 74 feet in 19,000 toises.

In 1780, the following parts of this stupendous undertaking had been proceeded with.

The taking the water by the *Pont Gouin*, and the trench for the aqueduct from the same point to Berchieres, a length of 20,000 toises, was in a considerable state of forwardness. The embankment of earth for 642 toises, from the neighbourhood of Berchieres to the valley of the same name had also been finished, and was then in a good condition. The aqueduct which was proposed by Vauban to be built on three ranges of arcades to traverse the valley, had never been commenced. Beyond the valley of Berchieres, an embankment prolonged its course toward the aqueduct of Maintenon, for 3,000 toises on the Berchieres' side, and was 44 feet above the general level of the ground; and on the Maintenon side, it was as much as 64 feet: 2,000 toises remained of the embankment at this height, the remainder being about half of that elevation. The part of the aqueduct bridge, traversing the valley of Maintenon, had only the first row of arcades finished. The embankment at Hondreville was finished, with the exception of an opening to be made through the forest of Ivelines, for about

2,000 toises, but the height did not require to be greater than between 14 and 20 feet, according to the inequalities of the ground. The part called the Etang de la Tour, being the first stage that furnished water to Versailles, as far as the reservoir, situated on the hill Gobert, was in very good condition.

The waters of the aqueduct were intended to be collected into four reservoirs, constructed on a hill situated about 2,000 toises from Versailles. Their area was equal to sixteen arpens, and had a depth of 12 feet excavated.

The declivity of the channel, from the point where the water was introduced into the aqueduct at the Pont Gouin, was found to be 75 feet; the reservoirs were 40 feet above the court of the palace.

In 1788, some idea was entertained of proceeding with this gigantic work, but shortly afterwards, the lands through which the aqueduct passed were sold, and a part of the embankments filled up, and a greater part of the aqueduct of Maintenon was demolished. This circumstance is exceedingly to be regretted, as from some accurate levels, the aqueduct had a summit height, sufficient to have allowed the surplus water to have been conducted to St. Cloud and Paris.

In the engraving marked *Aqueduct of Maintenon*, fig. 1, shows an elevation of part of the entire composition; the first range of arcades being all that was finished. Fig. 2, is a section. Of this first range of arcades, there are now only a few arches in existence, and so rapid has been the dilapidation, that it is probable, in a few more years, not a vestige will remain of this work, equal in conception and in execution to any of the similar works of the Romans.

In the description of the aqueducts of Lyon, Nismes, Metz, Spoletto, Bourgas, Caserta Castellana, Montpelier Maintenon, and the three modern aqueducts at Rome, the measures mentioned are those of France, of which

		Inches English.
The millimetre	=	0·03937
A metre	=	39·3710
A toise	=	76·7360
A foot	=	12·7893
A line	=	0·0888
An inch	=	1·0657*

Arabesque, (Fr.) a building after the manner of the Arabs. Ornaments used by the same people in which no human or animal figures appear, representations of these being forbidden by the koran. Sentences from the koran introduced as ornaments to buildings or apartments, occasionally interwoven with foliage and geometrical figures. Intricate lineal compartments, and chiligon mosaics which adorn the walls, ceilings, and floors of Arabian buildings. The term is synonymous with *moresque*, (which see.)

Arabesque is sometimes, but improperly, used to denote a species of ornament composed of capricious, fantastic, and imaginary representations of animals and foliage, and works of art, much employed in the decoration of walls and ceilings by the Romans, during and after the reign of Nero, and probably at an earlier period by the Greeks, who may have derived it from the orientals. Count Caylus says it was brought from Egypt, adopted by the Greeks, and received among the Romans in the age of Augustus. These ornaments have been sometimes called *grotesques*, after the Italian name *grotesca*, (which see) given from examples of this style of ornament, having been discovered ornamenting some (now) subterranean buildings or grottoes.

By some antiquaries these

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* See Supplement.

ornaments have also been called *romanesques*. Another author, whose eminence in art entitles his opinion to great consideration, called these productions *bizaresque*, as involving no theory, and being expressive of the general character of the style, and ranged them into the periods in which the taste, or subjects underwent an alteration :—Egyptian—Etruscan—the Neronian period—that of Diocletian—of Constantine—the gothic and Saracenic periods, and that introduced by the northern mediæval architects—the revival of the style by the prince of the Roman painters in the fifteenth century, and of which his specimens in the Vatican may be considered as the perfection, until the period of the decline of the Raffaelesque taste in the productions of the French artists.

Ancient walls were painted from the earliest periods, and pannels of rooms with flowers in the centre are found at Thebes. Pausias, the Sicyonian, introduced the custom among the Greeks. These paintings appear to have been varnished by an encaustic process. A Roman, according to Pliny, was the inventor of *Roporography*, or fantastic slender columns, formed of parts of animals and flowers, common at Pompeii, and imitated in the divisions of modern paper-hangings. The grotesque, or fantastic representation of *animals and men*, also borrowed from Egypt, is, according to Caylus, purely Roman.

Arabesques, properly so called, appear to have been introduced into Europe by the Moorish conquerors of Spain; and from this point, it is probable, that their use was diffused in the neighbouring countries. There are numerous points of resemblance between arabesque ornaments and those decorating what are now called gothic, or pointed style, buildings in France and England, and some curious specimens in Portugal. The only works which can be referred to by the architect for examples of these buildings, are those by the Murphys, father and son. "The Arabian Antiquities of Spain," by the late J. Cavanah Murphy, an honour to the age which produced it, contains numerous specimens of *pure* arabesque ornaments.

ARABIAN ARCHITECTURE. Various and remote, says the author of the "History of the Spanish Arabs," were the sources whence the Arabians derived their notions of the arts. Some rudiments of the arts of surrounding nations—the Egyptians, Syrians, Chaldeans, and Persians, were in all probability introduced among them by commercial intercourse at an early period, but these germs continued to be like their dreary deserts, unimproved and uncultivated. Secluded by situation in a great degree from intercourse with the neighbouring countries, they acquired in a state of lawless independence habits averse from the cultivation of the arts and sciences. Previously to the time of Mahomet, it is certain that they possessed only a scanty knowledge of the arts, and before the institution of Islamism, they appear to have been extremely deficient in the art of building, even in the beautiful country of Yeman. Yet in this province were situated the most ancient and populous of the forty-two cities of Arabia, enumerated by Abulfeda, of which Sanna and Merab were the most distinguished.

Sanna the capital, was celebrated for its lofty towers; and, by Abulfeda, is compared to Damascus. Merab, which was destroyed by the Roman legions under Ælius Gallus, is said to have been six miles in circumference, and was famous for its vast reservoir, formed by a narrow valley between two ranges of hills, and a day's journey in length. Into this flowed the waters of six or seven small rivers. The narrow entrance of the valley was shut up by a solid wall of hewn stone, 50 feet in height; on which many of the inhabitants erected dwellings, and in which three flood-gates were erected one above another, to regulate the distribution of the water over the valley; but "God," says the Nubian geographer, "being highly displeased with their great pride and insolence, sent a mighty torrent by night which swept away the whole city, together with many neighbouring towns and people." Niebuhr, however, says the destruction of this celebrated dam, arose from neglecting to repair the mound. When the Sabæan kingdom declined, the neighbouring fields being no longer watered, became waste and barren, and the city was thus left without the means of subsistence.

One of the most distinguished architects of ancient Arabia, according to the same author, was Sennamar, who is supposed to have been a Chaldean by birth. By him were erected for Noman al Aouar, the tenth king of Hira, the castles or towers of Sedir and Khawarnak, celebrated among the Arabians as having been one of the wonders of the world. With such skill, it is said, were these buildings erected, that a single stone tied together each entire structure, and what was equally miraculous, the colour of the stones with which the walls are built, changed (camelion like) several times in the course of the day. The fate of the architect was remarkable, and gave rise to the Arabian proverb, "the reward of Sennamar." To compensate him for his labour, the sovereign made him very splendid presents, but considering afterwards that Sennamar *might* erect similar towers for his enemies, and fearing also least he should discover the keystone of the building, he commanded him to be precipitated headlong from its summit into the ditch that surrounded it.

Of the monuments of ancient architecture in Arabia few have been preserved, and the best accounts are uncertain and unsatisfactory. The supposed houses of the people called Thamud, it is said, are still seen in the excavations of rocks; but of the seven ancient temples, in which the Arabs worshipped their idols, that called the Caaba at Mecca is the only one that has survived the desolations of time. This quadrangular building is 24 cubits long, 23 broad, and 27 high. A door on the east side and a window admit the light; the double roof is supported by three octangular pillars of aloes wood, and a spout formerly of wood, but now of gold, discharges the rain water. The munificence of a king of the Homerites, who reigned one hundred and twenty years before the christian era, covered this holy temple with *striped* cloth and fine linen, and made keys for its gate. This decoration was continued by the successor of Mahomet, and the modern veil of black silk fringed with gold is annually renewed by the Turkish emperor. Since the promulgation of the koran, the Caaba is the fixed point (or kibla) of the horizon, to which the Moslems in every part of the world turn their faces when they pray. It is now encompassed by a spacious quadrangle, the work of successive khalifs, consisting of porticoes and apartments for the accommodation of the pilgrims who resort to it from various parts of the east. But the tombs of the eighty descendants of Mahomet, and of his wife, no longer excite the veneration of the Moslems. They were levelled by the Wahabees in 1803, who, however, spared the Caaba, and its surrounding buildings.

Whatever knowledge of the arts the Arabians acquired in the ages subsequent to Mahomet, they owed to the people whom they subdued from the Indus to the Nile, during the ten years' reign of Omar, the second khalif, who died A.D. 644. The victorious Moslems reduced to obedience thirty-six thousand cities or castles, destroyed four thousand churches, or temples of the Christians, and erected fourteen hundred mosques, for the exercise of their religion. Immediately after the surrender of Jerusalem, Omar founded a small mosque, the first perhaps which was erected out of the precincts of Arabia, upon the site of the ancient temple. By succeeding khalifs it was greatly enlarged and embellished, and according to D'Anville, its circumference is nearly a Roman mile, being 215 toises in length, by 172 in breadth. This edifice among the Arabians was reckoned to be second only to the magnificent Mezquita at Cordova.

With the extension of their empire and religion, the Arabians appear to have acquired a greater relish for the arts, and on the commencement of the Ommiad dynasty of khalifs, a taste for their cultivation began to show itself among the nation. When the first khalif of that race began his reign, he removed the seat of empire from Medina to Damascus, and laying aside the ancient frugality of the more ancient princes, he assumed the magnificence of an Asiatic monarch. During his reign, and that of his successors, Damascus was enlarged and adorned with numerous and splendid public buildings, among which the great mosque, founded by Alwalid I. is particularly celebrated. He attached to it the beautiful church of St. John the Baptist, and here he erected for the first time *a lofty minaret*, and during many years, he expended a great part of his revenue in embellishing these erections. This appendage was an innovation in the style which has since almost become its characteristic. Nothing can be more light and graceful than the general effect of these towers, and the pointed arches with which these indentical towers are decorated, give still greater importance to the erections of this khalif in the history of the origin of what has been named "Gothic, or Pointed Architecture." His love for architecture induced him to add considerably to the mosque of Medina, and to enlarge and adorn that built by the khalif Omar, upon the site of the temple of Solomon at Jerusalem. One of the generals of this prince, after passing the Oxus, and taking the city of Samarcand, built a superb mosque upon the spot which had hitherto beeen dedicated to the worship of heathen idols.—The example of the commanders of the faithful was imitated by the governors of the provinces: the artificers of Damascus and Heliopolis of Chalcis, and Antioch of Jerusalem, Tyre and Cæsarea, were enlisted in the service of the state, and the arts of Syria and Palestine became familiar and in request among the native hordes of the Desert.

But the reigns of the khalifs

of the house of Al Abbas were most propitious to the cultivation of the fine arts among eastern Arabs. The seat of empire which had been removed by the first of the Ommiad dynasty to Damascus, was transferred by the second khalif of the dynasty of the Abassides to the western frontiers of Persia; and Bagdad, founded by Almansur, in A. D. 762, continued for five centuries to be the splendid capital of the eastern khalifs. In the structure and decoration of this city, neither labour nor expense were spared, and the details of the gorgeous magnificence of the khalif's palace would almost exceed the ordinary limits of belief, were they not authenticated by contemporary and ocular testimony.

Egypt and Africa early yielded to the victorious arms of the Moslems, yet it does not appear that the Arabians founded any edifices between Alexandria and Ceuta before their invasion of Spain, except the citadel of Cairaen (or Cairo) founded by the victorious general Akbah. After various reverses, this city became the seat of learning and empire under the Fatimite line of khalifs, who in the tenth century founded the new city of Cairo, and affected to rival the splendour and fame of the Bagdad princes in the magnificence of their buildings, and in their patronage of the arts. Numerous vestiges of their ancient buildings are still to be found at Cairo, and among the stately edifices with which it is adorned, the great mosque may be mentioned, which is accounted the most sacred and magnificent in Barbary, and said to be supported by five hundred columns of granite porphyry and Numidian marble.

In arts and sciences, the Arabs of the west were not inferior to those of the east: the buildings erected by the Ommiad khalifs of Spain rivalled those of Damascus, Bagdad, and Cairo, even in the days of their greatest splendour. The superb magnificence of the mosque at Cordova, of the city and palace of Azzahra, he palaces of the Alhamra and El Generaliffe, are equal to any thing recorded of the most splendid cities of antiquity.

Almost all of their towns were placed in fine or romantic situations, and not a few were of remarkable construction. The town called Zahara, in Spain, is nearly inaccessible, the only path to it being on one side of the mountain on which it is placed. The streets and houses are scooped out of the solid rock; the descent down the precipices of the backs of the habitations which are close to its edge, is at least 1200 feet. In other instances, their masonry was almost as durable and stable as their excavation—the remains of the admirable bath near Cintra, both in style and execution, are equal to the finest masonry of Greek buildings.

But in reviewing the various remains of Arabian art, continues the historian of the western Arabs, it is a circumstance worthy of remark, *that no people ever constructed so many superb buildings, who extracted fewer materials from the quarry.* From the Tigris to the Orontes, from the Nile to the Guadalquiver, the buildings of the first conquerors were raised from the materials of ruined fortresses, castles, and cities. Modian and Babylon furnished materials for the public and private edifices of Bagdad—the dismantled towns and temples of Syria might suffice to raise the mosques and palaces of the Ommiad khalifs. In Egypt, Old Cairo was transformed into the new city of that name, and the land was strewed with vestiges of the monuments of the Pharoahs, the Ptolemies, and the Cæsars. The mosque of Mercy, at Alexandria, was composed of the recent ruins of the city, and erected on the spot where the victorious Amru arrested the fury of his troops. The work of destruction kept pace with the progress of conquest along the western coast of Africa. Five hundred episcopal churches were overturned in their progress from Tripoli to the Atlantic, many of whose ruined fragments were afterwards collected and cemented in the modern buildings of Tunis and Algiers, and the mosques of Cordova were decorated with the spoils of Carthage.

In Spain, almost innumerable instances occur of Roman foundations having Arabian substructures: a few may be particularized. At Alora, near Antequerra, a castle has the basement in Roman brickwork, and the walls decorated with the horse-shoe arch. The entrance gate, called the Giant's Arch, is considered one of the most beautiful examples of the Moorish taste in building. Within the enclosure is the church of Santa Maria, formerly a Mahomedan mosque, and is now used as a christian church, without any other alteration than being profusely decorated with bad pictures. The castle of Lebrixa has the lower part of its walls of Roman brickwork in some places 30 feet high, and gradually diminishing in thickness, each tier of brick standing further in than the one below it; the wall resembles a stair. The Moorish additions to its height being, however, carried up *perpendicularly*, and the arches of the horse-shoe form.

What most of all contributed to the improvement of Arabian architecture, was their becoming acquainted with the mathematical writings of the Greeks and Romans. The first Moslems having no idea of building beyond their native plebeian habitations, caused the artificers of the conquered countries hastily to pile up the fragments of plundered structures according to their rude instructions. But when in latter times their zeal for making conquests had subsided, and the riches of their subjects had put the means of indulging the taste for magnificence in their power, they became as much distinguished for the zealous patronage of the arts and sciences, as they before had been for the rage with which they had destroyed the objects consecrated to both. Cordova contained six hundred mosques, nine hundred baths, and two thousand houses. It had eighty cities of the first order, and three hundred of the second and third order; and the banks of the Guadalquivir were adorned with twelve thousand villages and hamlets.

Towards the close of the seventh century, they had translated the works of the great mathematicians into their language, and if we may judge by their buildings, they had profited greatly by their assistance in the science of construction. The science of architecture was discussed by some of their learned men, and Rashid composed a treatise on this subject in three volumes, and the Katab Al-haitan, or art of building, was commented upon by Damaguni, a distinguished cadi or magistrate.

It is a prominent feature of Islamism, that wherever it is professed, it diffuses a general resemblance of manner and opinions. Hence, as the climate of southern Spain was in many respects natura-like to that of the warm climate of Arabia, we find that the manners of the Spanish Arabs were similar to those of their brethren in the east. In every place the conveniency of water was a grand requisite, and to this day Spain is indebted to the enterprise and skill of its Arabian possessors for many aqueducts and numberless canals of irrigation. Those of the mosque at Cordova, and the palace Granada, are still remaining to give us an idea of their size and beauty. Fountains were frequent in their streets as well as in the courts of their houses; and on contrasting the disposition of the apartments in their dwellings with the mode of building still prevalent in the east, we find a general resemblance in the style of architecture. In both we see large doors, spacious chambers, cloistered courts with fountains playing in the centre, ornamented tiles and elegantly executed mosaic work.

The prohibition among them to copy the human form, had a powerful influence in preventing their attaining great excellence in either painting or sculpture. In one or two this was however disregarded—and some of the walls in the Alhamrā were ornamented with some paintings of men and horses, and one of the khalifs erected the statue of his favourite mistress over the gate of a palace he had built for her reception; but the example was too violently opposed to the principles of the nation, and it does not appear to have had any influence towards the introduction of a taste for those embellishments. The exterior of their mansions was an object of comparatively little attention; upon the interior every thing was profusely lavished, that could tend to promote luxurious ease and personal comfort. And so admirable was the arrangement of air in their apartments, that no reverberation of sound existed, and and the light was generally admitted so as to exclude external prospects. (See *Alhamrā.*) They bestowed their utmost labour and skill in decorating the ceilings of their edifices. One of the most complete Arab houses now remaining in Spain is to be seen at Seville: it was originally erected for a Spanish Arab chieftain, and though it was at least five centuries since it was built, it was in perfect preservation in 1809.

The durability of the Spanish Arab buildings is truly astonishing. History indeed furnishes us with some well authenticated facts of the durability of wood. The gate of Cyprus belonging to the celebrated temple of Diana at Ephesus, lasted four hundred years, and that of the old church of St. Peter, at Rome, which was composed of the same material lined with sheets of silver, continued undecayed for five hundred and fifty years. But a more remarkable instance is to be found in the mosque of Cordova. The beams employed in the construction of its roof amounting to several thousand cubic feet of pine wood, manifest no signs of corruption or decay after a lapse of ten centuries.

The Spanish Arab fortresses, like the Acropoles of the Greeks, were erected on the summit of almost inaccessible heights, to which they retired when repulsed, until they again issued as assailants. Watch towers were here constructed, from which signals of smoke by day, and of torches by night, communicated the movements of their opponents.

The castle at Malaga, called Gibralfaro, built on the site of a more ancient Roman fortress, stands on a hill communicating with the city; the whole superstructure is purely Arabic. The entrances are protected by a contrivance generally found in their castles; over each door and window a kind of chimney is constructed, the bottom of which is level with the upper rooms of the entrance, and the top terminates at the parapet; through these chimnies the besieged could shoot their arrows on the heads of their assailants, and be themselves secure from attack. The Moorish walls of Lisbon, flanked by seventy-seven towers, were fourteen miles in circumference, and nearly six long.

There are also remains in this city of a magnificent building of another species, a kind of dry dock, admirably constructed, in which the Arabian gallies were laid up. It is now converted into storehouses.

On a careful review of the most perfect Arabian buildings, and on a comparison of them with the best preserved specimens of other styles, we may be justified in considering it as partaking chiefly of the Græco-Roman, or Byzantine, which prevailed in the lower Greek empire, and of the Egyptian. The former adopted when they overrun the Roman provinces in the east, and the latter when they subjugated Egypt under Amru, during the khalifat of Omar.

M. Laborde, in his voyage "Pittoresque de l'Espagne," assigns three distinct periods to the rise, progress, and decay of Moorish architecture; the first includes the space from the commencement of Islamism to the ninth century; the second from the ninth to the thirteenth century; and the third, from that time to the annihilation of the Mahometan dominion in Spain.

During the first of these periods, according to the same author, the finest specimen is unquestionably the mosque at Cordova, the plan of which corresponding in many respects with many of the oldest churches in Rome, and the materials with which it was constructed were either taken, or coarsely imitated from the Basclaine, which had previously been erected in Spain by the Romans.

Of the second period, the royal fortress and palace of Alhamrā present the most perfect model of pure Spanish Arab architecture. It was founded towards the close of the thirteenth century; from this period not a single vestige presents itself of the Byzantine, or Græco-Roman style in the Spanish Arab buildings.

The third period, from the end of the thirteenth century to the decline of the Arab dominion in Spain, is distinguished by a mixed style. The arts which had revived in Italy gradually diffused themselves over the west of Europe, and their influence, ultimately, was felt in Spain, where the Arabian architecture had assimilated itself with the Italian style. M. Laborde found some specimens of this mixed style in the fortresses of Benavente, Pennafiel, Cordesillas, Segovia, and Seville, as well as in one of the courts called the Patio de las Naranges.

A house built during this period at Seville still exists, which was the residence of a Moorish Arab chieftian; the whole is most voluptuously contrived for a warm climate, and is in the most perfect state of preservation, though upwards of five hundred years old: one of the apartments is almost perfect in its kind. The form resembles a double cube, the one placed above the other, its height about 60, and its length and breadth about 30 feet. The ornaments begin at about 10 feet from the floor, and are continued to the top of the room; they consist of a kind of variegated network, or stucco, designed with the most perfect regularity, and yet most admirable variety in the patterns, and the interlacings of each. This edifice has been often adduced as an instance of the wonderful superiority of the Arabs, over the modern Spaniards in the art of building.

The history of classic Arabian architecture then, comprises a period of about eight hundred years, during which, the style of the second epoch presents in the Alhamrā the purest and best preserved specimens of Arabian skill in the art of construction, particularly in the court of the lions, and in the hall of the Abencerrages. This style of architecture, considered by some authors as the parent of what is called the gothic style, is distinguished by the following characteristic features: by the crescent form of its arches; by the extraordinary lightness and elevation of a numerous assemblage of columns; by the springing naves, or mouldings of the ogives, either single or multiplied, that fit the arches, which *descending* upon the columns *either stop there*, or *rest on consols or trusses;* and by the prodigious quantity of ornaments either in relief or in mosaic, composed of chiligon figures almost infinitely varied; and the gorgeous assemblage of minute ornaments of the same description with which the roofs are encrusted or decorated. The "Arabian Antiquities of Spain," by Murphy, contain exquisite examples of these roofs, and of Arabian ornaments in general.

But it must not, however, be understood that, as a style, the Arabian was the same at any period in the various countries under their government; or even that it was uniform in the same country in the same period. Indeed, if we may judge from the remains of some buildings in Egypt and Syria, of nearly the same age, we shall observe very great differences, not only in the minutiæ of the ornamental and apparently characteristic ornaments, but also in their distribution. On this head, however, much yet remains to be done before a proper comparison can be instituted between the modes of different ages; for, with one or two exceptions, we have no details of the remains of Arabian buildings in those countries where their power was first displayed, and where its influence is still considerable. The buildings in the Peninsula, must, however, be considered as forming an interesting and important *class* only of edifices in this style.

The following notices are collected with a view of giving a general idea of the arrangement, decoration, and construction of modern buildings in those countries which may still be considered as Arabian, or at least as influenced by the taste introduced by that people during their government.

Some of the buildings enumerated, might probably have been better placed in the previous part of this article: but as we have no details, by which they could be classed with certainty, their position is not of any consequence.

The principal streets of *Mecca* are tolerably regular, they may even be called handsome, on account of the pretty fronts of the houses; they are sanded, level, and very convenient. The houses have two rows of windows with balconies covered with blinds. There are even several large windows quite open as in Europe, but the greater number are covered by a species of curtain like a venetian blind, made of palm-tree, which are extremely light, and screen the apartments from the heat of the sun without interrupting the passage of the air. They have holes cut in various parts of them as peeping places by the women.

These houses are solidly built with stone, generally three or four stories high, sometimes more. The fronts are ornamented with bases, mouldings, and paintings, which give them a very graceful appearance. It is very rare to find a door that has not a base with steps, and small seats on both sides. The roofs form terraces surrounded by a wall about 7 feet high, open at certain spaces, which are occupied by a railing formed of red and white bricks placed horizontally and symmetrically, leaving holes for the circulation of the air; and at the same time that they contribute to the ornaments of the front, they screen the women from being seen when they are upon the terraces.

All the staircases are narrow, steep, and dark. The rooms are well proportioned, long, broad, and lofty, and have, besides the large windows and balconies, a second or upper row of smaller windows. They have also a shelf all round as at Alexandria, to place various things upon, as well for ornament as use. The beauty of the houses may be considered as the remains of the ancient splendour of Mecca. Every inhabitant has an interest in preserving his dwelling to invite and excite the pilgrims to lodge with him, because it is one of his principal resources. There is no open place or square in Mecca. (See *Gate, Mosque, Turkish Building*.)

The streets at *Suez* are regular, but without pavement. The houses are substantial, and some of them elegant; but the general appearance is impressed with an air of decay.

At *El Hadda*, a town between Jidda and Mecca, the huts were all alike, quite round, and about seven or eight feet in diameter. The tops resemble cones, the summits of which are about 7 feet high. They are formed with sticks like a cage, and covered with palm-leaves and bushes. On the outside of the town, which was encompassed by a hedge, were *two circles* of empty huts, which were destined to lodge the caravans; and between the circles was a well. The town of Mona, in the same route, is composed of a single street upwards of a mile long, containing many handsome stone houses, some of them boasting of arabesque *stone* ornaments.

The traveller who approaches *Damascus*, believes he sees before him a vast camp of conical tents raised 10 or 12 feet above the plane of the earth, but on a nearer approach he perceives that these tents are nothing else than an infinity of conical cupolas, serving as roofs to all the rooms of the houses in the outward suburbs of the city. These cupolas are white, and nearly of the same form and size as the dove-houses of Egypt. On inquiry, we find this construction is useful and even indispensable. The houses are built of earth, or of bricks composed of a bad clay, and straw baked in the sun—and as the winters are very rainy in this country, if the houses had flat roofs, or were simply covered with tiles, made of the same materials as the bricks, it would be requisite to rebuild them every year. By using these elevated cones, the rains do not cause any devastation, as the water flows almost perpendicularly downwards. These cupolas, as well as the rest of the buildings, are covered with a coat of reddish white marl, and very smooth, which gives them a very pretty aspect, and considerable durability. The ancient houses are built with more solid materials, and have generally two stories with flat roofs, few windows, small doors, and unadorned fronts. The streets are well paved, have elevated foot-paths on each side of a regular width, though they do not run in regular lines. Damascus, like other cities inhabited by Arabs, has no *square* or public place; the custom of leaving open spaces in the middle of cities to ventilate and embellish them, is with one exception unknown to Mahometans of every nation. The more urgent necessity of guarding against the rays of a continually burning sun, has occasioned them to restrict the width of their streets, that they may the more easily shade them from the sun. There are, however, some tolerably wide streets at Damascus. The bazaars are covered with wooden virandas, which have windows open in the outer part; public baths are attached to these bazaars, constructed with considerable magnificence. The first saloon is generally large, and lighted by great windows looking into the street, and is covered with a fine cupola of wood, ornamented with arabesques, and round the apartment runs a raised gallery, used by those who have just left the baths. Every house has several fountains of water, and the city contains not less than five hundred houses, which in size and splendour may rank with palaces. The number of mosques is very great, but except that called Zekia, present nothing remarkable.

In Hamà are many houses built with stone; the greater number, however, have only the lower part so constructed, whilst the upper part is of brick covered with white marl, and many of them crowned with the conical cupolas as at Damascus. There are some edifices built in the European taste with large windows.

In the innumerable mosques ornamenting these towns, some are covered with lead, others with stone or marble, but most generally like those in Bagdad, cased with painted glazed tiles.

Bagdad also possesses several large void spaces, which we should call squares. The gates constructed by the khaliffs are still remaining; they are made to fold, 20 feet high, and 6 inches thick, plated with brass on both sides. The inside of the gates, under the walls, is one immense room without any division, 48 paces long, and 17 paces broad; the roofs are arched, having no other buttresses or support except the walls on which they rest.

The walls are of mud 25 feet thick, with parapets breast high, furnished with small embrazures for musquetry or arrows: the foundations are of burnt bricks above the level of the water when the ditch is full.

The ramparts of Bagdad are supported by strong arches built regularly within the walls. The houses on the outside make no appearance, they all have *subterraneous* apartments arched, and ornamented with handsome stucco work, to which the families retire about ten in the morning, where they dine and remain until about an hour before sun-set.

At Bussorah, where they have no timber but the wood of the date tree, which is like a cabbage stalk, they make arches without any frame. The mason, with a nail and bit of string, describes a semicircle on the ground, lays his bricks, fastened together with a gypsum cement, on the lines thus traced, and having thus formed his arch, except the crown brick, it is carefully raised, and in two parts placed upon the walls. They proceed thus till the whole arch is finished. This part is only half a brick thick, but it serves them to turn a stronger arch over it.

The architecture in Moorish or western Arabia, resembles in nothing the ancient or modern oriental. And far from finding in the recent buildings that elegance and boldness which distinguish the more ancient edifices in this style, they display only the greatest ignorance. The buildings are constructed without any plan, and seemingly at random, and with such an ignorance of the first rules of the art, that in some of the first houses, the staircase has not a single ray of light. In general the porches and staircases are shabby, even those in the houses of the nobles.

The form of the houses, as in the eastern parts of the ancient empire, consists always of a square court, of which two, three, or sometimes all the four sides are surrounded by a gallery. A very narrow room of the length of this gallery was parallel with it. But these rooms have generally no windows, nor any other opening except the door in the middle which opens on the gallery; hence all their dwellings are dark, and badly aired. The roofs of the houses are flat, and covered with the same kind of plaster with the floors.

The walls are generally made of lime, plaster, and stones, but more commonly of a kind of greasy clay beat up with water. In order to erect such a wall, two planks are placed perpendicularly with a sufficient space between them, into which is thrown the clay kneaded with water until it has acquired the consistency of paste; two men then beat it down between the two planks with their clubs. They accompany their work with songs, to which their clubs beat time. The difficulty of procuring strong beams obliges them to construct very narrow rooms, in order to make the small wood of the country answer their purpose. They put over it a bed of reeds, which they cover with plaster about a foot thick. This heavy ceiling crushes the walls, which seldom last long. The doors are of a very clumsy construction, and at Tangier, most of the locks are made of wood. The use of sewers, and other important conveniences, is totally unknown.

The architecture of the modern mosques is as rude as that of the houses. The principal mosque of each town is as usual composed of a yard, surrounded by arcades, and opposite its gate are several rows of parallel arches. The minaret is placed at the left corner; the arches and roof are very low; the timber-work, which is open, is very clumsy; and in general the construction is very indifferent.

In *Morocco*, the entries to the houses are formed by lanes so narrow and crooked that a horse can hardly pass them which enables the grandees in time of rebellion, to defend their houses from the rabble. They are sometimes built with stone, but in general with *tabbi*. In the palace are some very handsome workments, constructed by the present emperor in the European manner, with large windows looking into the garden, and a fine square saloon, but the staircase is very badly placed and very mean.

The walls of this capital are extremely thick, formed of a cement (called tabia, or tabbi, by the Arabs,) of lime and earth put in cases, and beaten together with square rammers. Livy says, "the walls of Saguntum were built with mortar made of earth:" so that this is the ancient mode.

The walls of *Rabat*, built by Almansar, are two miles in circuit and strengthened by square towers. These and the houses of the town (built by the Spanish slaves taken by the sultan in his wars with that country,) are not very strong. Tradition says, the Christians expressly built them so that they might fall in, and destroy their oppressors, for which they were decapitated "by thousands" at the iron gate. In the mosque at Labat which was erected by the same prince, were three hundred and sixty columns of fine marble, the ruins of which are still visible.

Some of the houses are exceptions however to the general style of the country, and are built with much elegance and taste, but being all behind high walls, they are not visible from the street, and even these outer walls are of the rudest construction, for every individual is anxious to conceal his wealth, and to impress the public and government with an idea that he is distressed and poor. The roofs are flat, and beat down with terras, a composition of lime and small stones.

The imperial palace is of hewn stone ornamented with marble. The openings of the principal gates have pointed arches, and embellished with arabesque ornaments. The walls of some of the rooms are of filagree work, and others of cerrulea or glazed tiles, which are fixed in the walls with much art, and have a pleasing and cool effect. In the gardens are pavilions about 40 feet square, covered with glazed tiles of various colours, and lighted from four lofty and spacious doors which are opened according to the position of the sun. They are painted and gilt in the arabesque style, and ornamented with square compartments, containing passages from the koran, in a sort of Arabic short hand, but now understood only by the first scholars.

The grand pavilion appropriated to the women, is in the middle of the enclosure. The M'Shoar, or place of audience, is near to the palace; it is an extensive quadrangle walled in, but open to the sky.

The body of the mosque, built by Muley El Monsore, is supported by many pillars of marble, and under it is a cistern, which holds a large quantity of water collected in the rainy season, used for ablution. The tower is built in a square form; the walls are 4 feet thick, and it has seven stories, in each of which are windows, narrow on the outside but wide within, which renders the inside light and airy. The ascent is not by stairs, but by a *gradually winding terrace*, composed of lime and small stones, so firmly cemented as to be nearly as hard as stone On the summit of the tower is a square lantern, which commands a most extensive prospect. The roofs of the different chambers are all quadrangular, and very ingeniously vaulted; the whole workmanship is of the most excellent kind. The tower of Beni Hassan, (so named from the province in which it stands,) is built of hewn stone, 150 feet high; and instead of steps, it has an inclined plane, forming a gradual ascent to the top, formed of a mixture of stone and lime which time has so hardened, as to be almost indestructible. A man on horseback may ride to the top of this building. At every two or three circles of the terrace are apartments built of solid stone. It is a local tradition, that the tower at Morocco, and the tower of Seville, were built after the same plan, and by the same architect, in the twelfth century.

The houses in *Fez*, an ancient Arabian city, are more lofty and spacious than those in some other towns. They have flat roofs ingeniously worked in wood, and covered with a sort of tarras, on which the inhabitants spread carpets in summer to recline upon, and enjoy the cool breezes of evening. A small turret, containing a room or two, is also erected upon them for the use of the females of the family, who resort thither for amusement or pastime.

The streets are narrow as usual, because the houses, which are also very high, have on the first floor a projection which intercepts much of the light, an inconvenience which is increased by a sort of galleries or passages which connect the upper part of the houses, and by the high walls which are raised at certain distances from one side of the street to the other, as if to support the houses. This practice is also followed at Alcazzar and Tetuan.

Behind these high walls houses are occasionally found, whose arrangement presents considerable elegance; but the rooms are long and narrow, like those of Tangier.

In the centre of each house is an open quadrangle, surrounded by a gallery which communicates with a staircase, and into which the doors of the different apartments open. These doors are both wide and lofty, and made of curiously carved wood painted in various colours. The beams of the roof of the different apartments are whimsically painted with gay colours in the arabesque style, and even have ornaments in gold and silver.

The ceiling is very lofty, in common houses this part is without ornament. The floors of the rooms are of brick. In the houses of the rich they are of flat square Dutch tiles, or of marble of different colours, placed so as to form designs rather pleasing. The portals of the houses are made of brick plastered over. The principal houses have (metferes) cisterns under them, containing water used in the baths, which are built of marble or stone; most of the principal inhabitants having baths in their own houses. Every house is also supplied with water from a river rising in the Atlas mountains, which enters the town by covered channels in two different places. A public bath is attached to each mosque, and also others open to the common people in other parts; the mosques, sanctuaries, and other public buildings being superlatively splendid. There are nearly two hundred caravanseras or inns, three stories high, containing from fifty to one hundred apartments, in each of which is a water-cock for ablution.

The principal mosque is constructed of bricks, stone, and lime, but without any pillars or architectural ornament. It has a great number of gates, and two handsome fountains in the court. The Elcaissera, as well as many of the other streets, that are filled with shops, are covered with wood shaped into arabesques, with openings or windows of various forms to admit the light.

The shops, as is general throughout the east, are very small, so that the owner sitting in the centre, can reach whatever his customers may require without rising.

The town contains a number of public hot baths, some of them good, containing different rooms, which are heated to different temperatures.

In *Tripoli*, the houses of the principal people differ from those of Egypt, which are mostly built three and four stories high; here they never exceed one story. You first pass through a sort of hall or lodge, (called skiffer,) with benches of stone on each side. From this a staircase leads to a single grand apartment, (termed a gulphor,) which has, what is not permitted in any other part of the building, windows facing the street. This apartment is sacred to the master of the mansion; here he holds his levee, transacts business, and enjoys convivial parties; none of his own family even dare enter this room without his particular leave. Beyond this hall or lodge is the courtyard, paved in proportion to the fortune of the owner. Some are of a brown cement, resembling finely polished marble; others are of black, or white marble; and in the poorer houses, it is of stone or earth. The houses either small or large, in town or country, are built exactly on the same plan. The courtyard is made use of to receive large female companies, entertained by the mistress on *state occasions*; on these occasions the floor is covered with mats and Turkey carpets, and is sheltered from the inclemency or heat of the weather, by an awning, covering the whole yard, for which the Moors sometimes incur great expenses.

In the palaces, during festivals, the area of the court is sometimes strewed with sand for the Pellowan or wrestlers to fall upon; and many hundreds of people may at these times be seen as spectators placed on the roof of the cloisters: at Algiers, also, this use of the court and terrace is common in the dey's palace.

There is something very analogous between this open space and the impluvium, or cava ædium, of the Romans, both of them being alike exposed to the weather, and both giving light to the house, and it is surrounded with a cloister, as the impluvium was with a peristylium, or colonnade. The veil, or awning, which has been mentioned, is expanded by ropes from one side of the parapet to the other, and may be folded or unfolded at pleasure. At festival times rich silk cushions are laid round for seats, the walls are hung with tapestry, and the whole is converted into a grand sala. The cloister is supported by pillars, over which a gallery is erected of the same dimensions, enclosed with a lattice-work of wood. From the cloisters and gallery, doors open into large chambers, not communicating with each other, and which receive light only from this yard; each of these chambers sometimes serves for a whole family, particularly when a father indulges his married children to live with him, or when several families join in the rent of one house. The windows have no glass, but are furnished with jalousies of wood curiously cut; these windows produce a gloomy light, which is admitted only through spaces one quarter of an inch wide, and crossed with heavy bars of iron. The tops of the houses, which are all flat, are covered with plaster or cement, and surrounded by a parapet about a foot high, to prevent any thing from immediately falling into the street. Upon these terraces the inhabitants dry and prepare their figs, raisins, &c. They enjoy on them the refreshing sea breeze, and offer up their devotions to Mahomet. From the terraces the rain-water falls into cisterns beneath the courtyard, which preserve the water from year to year in great perfection. No other soft water is to be had in this country.

A modern Tripolitan Fenduke or inn, built by the bashaw's wife, is described as very large, with a square area, in which is a well or gebia, or a marble reservoir for water to wash in before prayers or meals. Round the area is a number of small rooms, each for the luggage or merchandize of the person or persons who may sleep in the apartments over it. The camels, horses, and mules of the travellers are ranged around the yard. When a stranger arrives, the floor of an empty room is dusted by a Moor, and the guest is left in quiet possession of it.

In general, in the houses of the better fashion, the chambers are hung with velvet or damask from the middle of the wall downwards; the rest is adorned with ingenious wreathings and devices in stucco and fret-work. The ceiling generally of wainscot is very artfully painted, or else thrown into a variety of pannels with gilded mouldings and scrolls of the koran intermixed: the practice is most ancient throughout the east, for the prophet Jeremiah exclaims against "houses ceiled with cedar, and the beams painted with vermilion."

To most of the houses there is a smaller one annexed, which sometimes rises one story higher than the house. At other times it consists of one or two rooms only and a terrace, while others built over the gateway have all the conveniences that belong to the house. There is a door of communication from them into the gallery of the house, kept open or shut, at the discretion of the master, besides another door which opens immediately from a privy stairs down into the porch or street, without giving the least disturbance to the inmates of the house. These back or attached houses, are called Alee, or Oleah, (for the house properly so called is Dar, or Beet,) and in them strangers are lodged and entertained. In them also the sons of the family are allowed to keep their concubines, and to which the men retire for meditation or diversion; at other times they serve for magazines and wardrobes.

The little chamber that was built on the wall for the Shunamite by the prophet Elisha, the summer chamber of Eglon, the chamber over the gate to which David retired to weep for Absalom, were probably similar in situation and use to these apartments.

The interior of one of the apartments of the palace of the dey of Tripoli displayed considerable elegance. It was hung with dark green velvet tapestry, ornamented with coloured silk damask flowers, and sentences out of the koran were cut in silk, and neatly sewed on, forming a deep border at the top and bottom; below this the apartment was finished with tiles forming landscapes. The sides of the doorway, and the entrances into the room were marble, and according to the custom of ornamenting houses, choice China and crystal encircled the room on a moulding near the ceiling. Close beneath these ornaments were placed large looking-glasses with frames of gold and silver; the floor covered with curious matting and rich carpetting. Loose mattresses and cushions made up in the form of sofas covered with velvet and embroidered with gold, served for seats, with Turkey carpets laid before them: the tables are low, not more than 12 inches from the ground, and beautifully inlaid. In Arabian buildings, in this district of the present day, the roofs are made by Maltese who are sent for on purpose, as their art is not only esteemed superior to that of the native workmen, but peculiar to themselves.

The golphors and best rooms in the country houses of people of condition, are sometimes delightfully relieved by a considerable stream of clear flowing water, conducted in a marble channel through the middle of them. The floors and sides of the apartments are finished with coloured tiles, and the ceilings carved and painted in mosaic. In the inner court is a gebia, continually filled with fresh water from wells made near it, and which flows through it into the gardens. It is surrounded with a parapet of marble, and a flight of marble steps leads into it. There is only a broad walk left round it, which is paved or terraced, and into which the best apartments belonging to the house open, which affords a refreshing coolness to the house, and is most delightful during the extreme heat.

It is a strange fashion in the houses of Tripoli, that in almost all the rooms which are very long and narrow, there is at each end a sort of stage of planks about 4 feet high, with narrow stairs. These alcoves are furnished with rails, or balustrades, and wooden ornaments, and there is a door under each of them. These are made to contain the complete household furniture of a woman, as upon one of the alcoves the bed is placed, upon the other the wearing apparel, and that of the children. Under the one are the table utensils and victuals, under the other the remainder of the wearing apparel; by "this arrangement the middle of the apartment is nowise encumbered, and a man may keep in a house of three or four rooms as many women and their families without their being in the way of each other." A similar arrangement is often alluded to in the scriptures.

The walls of the great mosque to within 3 feet of the ceiling, are lined with handsome figured China tiles placed uniformly, and the ceiling is ornamented in the same manner. The sixteen marble columns have thin iron rods painted blue and gilt, reaching from one to another, and forming a large cheque-work through the whole edifice, about 6 feet below the roof, from which is suspended in festoons antique lamps with long silver chains. On three sides of the mosque are square bay-windows grated with iron, without glass. On the side towards Mecca is a pulpit of marble resembling alabaster, with a flight of fourteen steps enclosed with a marble balustrade. This pulpit is covered with Chinese tiles: over it is a small alabaster dome supported by four white marble pillars, which rest on the pulpit. The outside of this dome is entirely covered with gold. There is no seat, bench, or resting-place, in this mosque throughout. The windows, which are very low, and made deep on two sides, look into a cloister which surrounds the mosque, and on the third side, into a stone building, called the *Turbar*, or mausoleum of the royal family. All the mosques are adorned with minarets or spires.

If a few persons are excepted who are buried within the precints of some sanctuary, the rest are buried at a small distance from their cities and villages, where a great extent of ground is allotted for that purpose. Each family has a particular portion of it walled in like a garden. In these enclosures the graves are distinct and separate, having each of them a stone placed upright both at the head and feet, whilst the intermediate space is planted with flowers, bordered round with stone, or paved with tiles.

Inscriptions are found only on tombs belonging to people of consequence, and their tombs are whitewashed and kept in constant repair: those of the great are distinguished by a marahut, or small chapel, being built over them, which is periodically whitewashed and kept in the neatest order, and supplied from time to time with the most expensive flowers placed in China vases during the life of any near relation: in others, lamps are kept always burning. The little chapel is open on four sides;—it has arches from the top to the ground closed with iron rails handsomely wrought and gilt.

Notwithstanding the perishable nature of the greater number of their buildings, where extraordinary strength and durability were required, throughout western Arabia they seem to have used, and now do use, mortar to all appearance of the same consistency and composition with that of the ancients. Those cisterns which were built by sultan Ben Eglib in several parts of the kingdom of Tunis, are of equal solidity with the famous ones of Carthage, and continue to this day as firm and compact as when they were just finished. The composition is made in this manner: they take two parts of wood-ashes, three of lime, and one of fine sand, which after being well sifted and mixed together, they beat for three days and nights incessantly with wooden mallets, sprinkling them alternately with a little oil and water, till they become of a due consistence. This composition is chiefly used in their arches, cisterns, and terraces; but the pipes of their aqueducts are joined by beating tow and lime only together with oil; these two compositions quickly assume the hardness of stone, and suffer no water to pervade them.

Instead of common glue, the joiners frequently use a preparation of cheese, which is first pounded with a little water in a mortar, till the wheyey matter is washed out. When this is done, they pound it again with a small quantity of fine lime, and apply it afterwards as quick as possible to such boards as are to be joined together, which, after the cement becomes dry, will not be separated, it is said, even by water itself.

The Bedouins live in tents called khymas, from the shade they afford the inhabitants; and beet el shar, or houses of hair, from the materials they are made of. They are the same with what the ancients called mapalia, which being then, as they are to this day, secured from the heat and inclemency of the weather, by a covering only of such hair cloth as coal-sacks are sometimes made of, might very justly be described by Virgil to have thin roofs. When a considerable number of them are placed together, they are generally arranged in a circle, and the collection is then called a *douwar*. The fashion of each tent is the same, being of an *oblong* figure, not unlike the bottom of a ship turned upside down, as Sallust long ago described them, "oblonga *incurvis* lateribus tecta quasi navium carinæ essent." They differ in bigness according to the number of people who live in them, and are accordingly supported, some with one pillar, others with two or three, whilst a curtain or carpet, placed upon occasions at each of these divisions, separates the whole into so many apartments. The pillar is a straight pole 8 or 10 feet long, and 3 or 4 inches thick, serving not only to support the tent, but being full of hooks fixed for that purpose, the Arabs hang their clothes, saddles, and instruments of war upon it.

The dashkras of the Kabyles, consist of a collection of *gurbies* as the dourwas do of khymas. These gurbies are generally raised either with hurdles daubed over with mud, or else they are built out of the materials of some adjacent ruins, or with square cakes of clay baked in the sun. The roofs are covered with straw or turf supported by reeds, or branches of trees. There is rarely more than one apartment in the largest of them, notwithstanding it is to serve for a kitchen, dining-room, and bed-chamber; besides one corner of it that is reserved (as is also the case in each khymas,) for their foals, calves, and kids. These hovels are always fixed and immovable, and according to Virgil, Carthage itself was nothing more than a collection of gurbies before the time of Dido.

The accompaniments of the buildings as objects in landscape gardening are, and probably have been, of the simplest and most inartificial although formal kind. A garden secluded from every eye but those of the household, and formed into square parterres, where the kitchen and flower garden were united. The garden of the Alcazzar, at Seville, which is said to have been laid out by the Moorish Arabs, and is preserved in its original state, contains walks paved with marble, parterres laid out with evergreens, and well shaded with orange trees. In many parts of it there are baths supplied by marble fountains from an aqueduct, and they have a contrivance for rendering the walks one continued fountain, by forcing up small streams of water from minute pipes in the joining of the slabs, which in this climate produces a most grateful effect. As a specimen of an Arab garden in its original state, this is an interesting object; recesses for shade and seats of repose, are here the only ornaments admitted.

Arabo-tedescho. A German name for a manner of building practised in the middle ages, in which the Moorish or Arabian manner is mixed with the debased Roman, or byzantine and pointed styles. The term is seldom used by modern authors. It is sometimes written after the Italian orthography—*Arabo-Tedesca.*

Araignee. (Fr.) *In military architecture.* A branch, return, or gallery of a mine.

Aræostyle. (*araios*, rare, or thin set, and *stulos*, Gr. a column.) One of the five proportions by which the ancients regulated the intervals, called intercolumniations, between the columns of porticoes and colonnades.

Vitruvius does not determine the precise measure of the aræostyle in terms of the diameter of the column, which has led various of his commentators to supply the deficiency or omission. Following the same progression observed in the other intervals, which increase each a semidiameter, the aræostyle should be equal to three and a half diameters. Perrault, in his translation of Vitruvius, proposes that the interval be made equal to four diameters. Another author thinks that Vitruvius alluded to a much wider space than even that assigned by Perrault, and he makes it five diameters. In modern practice the word denotes the intercolumnar space of four diameters. Its use is restricted to apertures decorated with the tuscan order.

Aræosystyle. Among French architects, a manner of proportioning the intervals between columns ranged in pairs, invented by Perrault, and introduced in his most celebrated work—the "River Front of the Louvre." The same arrangement has also been followed by sir Christopher Wren in the west front of St. Paul's.

This kind of disposition is composed of two systyle intercolumniations; the column that separates them being approached towards one of those at the extremities, leaving sufficient room for the projection of the capitals, so that the great space is three and a half diameters wide, and the small one only half a diameter.

Blondel objects to this innovation on account of its want of solidity, and its great expense; since almost double the number of columns is required that would be sufficient in the diastyle interval, and great irregularities that its adoption occasions in the ornaments of the entablatures of the various orders. Notwithstanding one or two examples of coupled columns in antique buildings, the aræosystyle invention may be safely considered to be a barbarism.

Arbalestena. See *Archeria.*

Arbores. Large bronze candelabra, in the shape of a tree, placed on the floor of ancient churches, so as to appear growing out of it. They were usually of exquisite workmanship, and often sumptuously adorned with silver, and gold, and gems.

Arc. *(Arcus,* a bow.*) In constructive geometry.* Any part of a curve line which does not consist of contrary curvatures.

It is by means of circular arcs that all angles are measured, the arc being described from the angular point as a centre. For this purpose every circle is divided into three hundred and sixty equal parts or degrees, and the number of these parts included in the curved line, is the measure of the arc, or of the angle. *Concentric arcs* have the same centre. *Similar arcs* bear the same proportion to their respective but different circles. *Equal arcs* have the same length, or contain the same number of degrees of the same, or an equal circle.

The length of circular arcs may be found and expressed by the following series, where the radius is made unity; and of any arc a, if the tangent be t, the sine s, and the co-sine c, and the versed sine v, then the arc a will be truly expressed by the several series—

$$a = t - \frac{1}{3}t^3 + \frac{1}{5}t^5 - \frac{1}{7}t^7 + \frac{1}{9}t^9 \text{ \&c.}$$

$$a = \frac{s}{c} - \frac{1}{3}\cdot\frac{s^3}{c^3} + \frac{1}{5}\cdot\frac{s^5}{c^5} - \frac{1}{7}\cdot\frac{s^7}{c^7} \text{ \&c.}$$

$$a = s + \frac{1}{2\cdot3}s^3 + \frac{1\cdot3}{2\cdot4\cdot5}s^5 +$$

$\frac{1.3.5}{2.4.6.7}s^7$, &c.

$$a=\frac{3.14159}{180}d=0.0174529+d,$$

where d denotes number of degrees in the given arc, and

$a=\frac{8c-}{3}c$ nearly; c being the chord of the arc, and c chord of half the arc, whatever the radius is.

Arca custodiæ. *In Roman architecture.* A kind of cage or cell, with bars of oak for confining criminals. They were made of lattice-work, with a privy for prisoners of war. It is also the name of a land-mark, formed square and hollow like a chest; inscribed stones.

Arcade. (Fr.) A series of apertures or recesses with arched ceilings or soffets. The use of this word is very vague and indefinite. By some authors it is used for a single arched aperture, or enclosure, instead of *vault*; or for the *space* covered by a *continued* vault, or arch supported on piers or columns, instead of *gallery* or *corridor*; and by others for the *space* enclosed by two or more arcades, or a wall and an arcade, instead of *piazza* or *ambulatory*.

A series of arched openings, though not so magnificent as a range of lintelled apertures, is more solid, stronger, and less expensive, They are, therefore, employed with advantage instead of colonnades round public squares, markets, large courts, and, in general, in all situations where wide spaces are desirable.

In some modern Italian towns the streets on each side are lined with arcades like those of Covent-garden and the Royal Exchange which add greatly to their magnificence. In rainy climates these arcades opening into a piazza are exceedingly convenient, forming a sheltered walk in all weathers; and in oriental buildings of all kinds their use is general for their grateful shade.

They are sometimes introduced on a small scale in English buildings to form corridors, but as a street decoration they are seldom used. The English mode ot building seldom admitting of very lofty stories, they are objected to as darkening the apartments to a degree inconvenient in our gloomy climate; besides, (though without sufficient reason,) being considered as impeding the free circulation of air.

"At Rome, the courts of the Vatican, those of Monte Cavallo, and of the Borghese, and many other places, are surrounded with arcades," forming piazzas, "under which the carriages and domestics wait under cover, some of them being sufficiently capacious to admit two or three coaches abreast. Such conveniences would be very useful in this country contiguous to the courts of law, churches, places of public amusement, and even to most houses of the nobility and gentry, where numerous fine equipages and valuable horses stand half the night exposed to all weathers."

"The void or aperture of the arcade," says the same author, "should never be more in height, nor much less than double their width. The breadth of the pier should seldom exceed two-thirds, nor be less than one-third of the width of the arch, according to the character of the composition; and the piers at the angles should be broader than the next by one-half, one-third, or one-fourth."

"The thickness of the piers depends on the width of the portico, and the weight which the arcade has to carry above; for they must be strong enough to bear the burden and to resist the pressure of the vault of the portico. With regard to the beauty of the building, Chambers says, the pier should not be less than one quarter of the width of the arch, nor more than one-third; and when arches are closed up to receive doors, windows, or niches, the recesses should be deep enough at least to contain the most prominent parts of what is placed in them; otherwise the style of architecture will appear flat, and the cornices of the niches or windows projecting before the fronts of the arcades, will become too powerful and striking in the composition."

"The area, enclosed by arcades, or by a wall and an arcade, may have a flat ceiling, or may be arched in various manners. When the ceiling is flat, the corresponding inside faces of the piers may be ornamented with pilasters, or the pier may have this ornament corresponding to another placed on the wall, forming the outer boundary of the corridor. Their projection may be from a sixth to a quarter of their diameter. These pilasters may support a continued entablature, or one interrupted and running across the portico over every two pilasters, in order to form coffers; or the architrave and frieze may be continued while the cornice only is carried across the portico, over the pilasters as before, and serves to form compartments in the ceiling."

"Where the portico is arched with a semicircular, or elliptical vault, the backs of the piers and inner wall of the portico may be decorated with pilasters, as already described, supporting a regular continued entablature; from a little above which the arch should take its spring, that no part of it may be hid by the projection of the cornice."

"The vault may be enriched with compartments of various regular polygonal figures, enclosing other decorations which are peculiar to *ceilings*, (which see.) But when the vault is groined or composed of flat, circular, or domical coves, sustained on pendentives, the pilasters must be as broad as are the columns in front of the piers; but they must rise no higher than the top of the impost, the mouldings of which must finish and serve them, instead of a capital from whence the groins and pendentives are to spring, as also the bands, or *arcs doubleaux*, which divide the vault."

"There are various modes of decorating an arcade externally; sometimes the pier is rusticated, at others a pilaster is placed on it, or a column, or a terminus, or caryatides; and on some occasions the piers are made broad enough to admit a niche or window."

"The circular part of the aperture is either surrounded with rustic archstones, or with an archivolt enriched with mouldings; which, in the centre, is generally interrupted by a keystone in the form of a console, a mask, or some other proper ornament of sculpture, serving at the same time as a key to the arch, and as a seemingly necessary support to the architrave of the order. Sometimes the archivolt springs from an impost placed at the top of the pier, and at others from columns, with their regular entablature or architrave cornice placed on each side of the arch; and there are some instances of arcades without any piers, the arch of their ceiling springing from single or coupled columns, sometimes with and sometimes without entablatures, as in the temple of Faunus, at Rome, a practice seldom to be imitated, being neither solid nor handsome."

"When the arched openings of the arcade are wide, the key-stone should never be omitted, but cut into the form of a console, and carried close up under the soffet of the architrave, which, by reason of its extraordinary length of bearing, requires a support in the middle. And if the columns that adorn the piers are detached, as in the triumphal arches at Rome, it is necessary to break the entablature over them, making its projection, in the interval, no more than if there were no columns at all; for though the architrave might be made sufficiently solid, yet it would be disagreeable to see so great a length of entablature hanging in the air without any prop or apparent support."

"It is, however, to be remembered, that these breaks in entablatures should be very sparingly employed, never indeed but to avoid some considerable inconvenience or deformity, for they are unnatural, render the columns or other supports apparently useless, destroy in a great measure the simplicity of the composition, and can seldom be contrived without some mutilations, or striking irregularities in the capitals. The imposts of arches should never be omitted, unless platbands supply their place. In all arcades the arches must not spring immediately from the impost, but take its rise at such a distance above it, as may be necessary to have the whole curve seen at the proper point of view. When archivolts are employed without a key or a console in their middle, the same distance must be preserved between the top of the archivolt and the architrave of the order, (if one is used,) as when there is a key, or at least half that distance; for when they are close to each other their junction forms an acute and disagreeable angle."

Arcæ. (Lat.) *In Roman architecture.* The gutters of the cavædium. The word *arca* is used to signify a beam of wood, which has a groove or channel hollowed in it from one end to the other.

Arcæ arculæ. In square sarcophagi, with the sides expanding and generally resting upon feet imitating those of a lion or other beast.

Arca pollinaria. A mill-trough.

Arc-boutant. (Fr.) An arched buttress formed of a flat arch, or part of an arch, abutting against the feet or sides of another arch or vault to support them, and prevent their giving way in that direction. "Arch-formed props employed in the pointed style for sustaining the vaults of the nave, their lower ends resting on the pilastered buttresses of the aisles, and their upper ends resisting the pressure of the middle vault against the several springing points of the groins. They are sometimes called *flying buttresses*, *arched buttresses*, *arch butments*."

Arcella. *In mediæval architecture.* A cheese-room.

Arch. *In geometry.* Part of a circle, not more than a half. Amongst modern mathematical writers the term is disused, except as restricted to its usual acceptation among builders and mechanics.

Arch. *In building.* A mechanical arrangement of separate inelastic bodies in the line of a curve, which preserve a given form when resisting pressure. A part of a building suspended over, or from, a given plan, and supported or resisted at its extremities, and concave towards the plan. A concave structure raised or turned upon a mould, called its centering, in the form of an arc of a curve, and serving as the inward support of some superstructure. A building open below and closed above, standing by the form of its own curve. A ceiling composed of stones, which, by acting against each other, are supported by the same force by which they would otherwise fall.

An aperture formed of bricks or stones of a wedge or like tendency, by which it is adapted to resist perpendicular and lateral pressure, so as to support the edifice built over it. An opening in a bridge through, or under, which the water and vessels pass. A concave ceiling, or floor, of any material, or on any principle of construction. A tunnel. An excavation.

An arch, says sir Henry Wotton, is a narrow contracted vault, and a vault is a dilated arch.

The supports of an arch are pillars or walls, called *abutments*, *butments*, or *piers*. The first, or lowest stones, or courses of stones, that form part of the arch, are called *springers*; and the line on which they are placed, or from which the arch begins to rise or spring, is the *springing line*, or *reins* of the arch. The *impost*, or *platband*, is the upper end of the pier on which the arch rests. The stones ranged in the curved line are called *archstones*, or voussoirs; the lower end of the stones form the interior, or curve of the arch, the whole of which concave surface is called the *intrados* by geometers, or soffet among architects. The *extrados* is the upper or opposite *convex* surface of the archstones. The *span*, or *chord of the arch*, is measured from the points or lines, where the intrados rises from the impost. The *rise of the arch*, or its versed sine, is the distance of the highest point of the intrados above the chord line. This highest point being by some geometers called the *vertex* of the arch, sometimes the *crown*; but among workmen and builders, the highest point of the intrados, or vertex, is called the *under side of the crown*, the *crown* being the *upper end* of the stones highest in the arch. The upper or centre stone of the series of archstones, or voussoirs, which connects the opposite portions of the arch, and binds them together, is the *keystone* or *key*. The *haunches*, or *hances*, or *flanks*, among geometers, are the spaces included between a horizontal line drawn from the vertex of the arch, and a perpendicular touching the springing line of the intrados; but among masons, the *hances*. *Flanks* are the spaces included between the extrados, and a horizontal line from the *crown* of the arch, and a vertical line from the springing of the extrados. When this space is not built up with solid masonry throughout the breadth of the arch, the walls built upon the voussoirs to the same height, are called *hance* or *flank walls*; the outer wall forming the elevation of the arch is the *spandrel wall*. Sometimes a circle-arch is constructed through the spandrel and haunch walls, which workmen designate an *ox-eye*,—the extrados prolonged by an arch of a reversed curvature passing over the pier, and connected with a similar prolongation of the opposite arch, is called a *strutt arch*, or *strutt course*.

In the decoration of arches, the *archivolt* is a collection of mouldings, on the face of the archstones, concentric with the intrados. The key-stone, when ornamented, is sometimes named from its ornament, as a *console*, or an *arcone*. Some of the mediæval bridges have the intrados formed into pannels, by hollowing each alternate row of archstones to a certain depth parallel with the intrados; the projecting row of voussoirs are then called *ribs*, and in arches generally the same name is given to any *single course* of stones forming an arch.

The outside face, or elevation of the spandrel wall, is called the *spandrel*; this, when the arch has an archivolt, is included in the space between the outer moulding of the archivolt, and a perpendicular from the springing of this moulding, from the impost and the horizontal moulding or projection surmounting the arch.

Arches are also denominated, from the similarity of their intrados to the periphery of the sections of various geometrical solids, as semicircular, elliptical, parabolical, cycloidal, catenarian, &c.

Circular arches are called by the earlier architectural authors *arches*, by way of eminence. Their *perfect arch*, being a semicircle, the *imperfect*, *scheme*, *skeen*, *skene*, *surbassed*, or *diminished arch*, being formed of a portion less than a semicircle. A *rampant arch* rises from imposts of different heights, or has its chord inclined to the horizon. An *arabesque*, *moresque*, or *saracenic arch*, has its chord line less than other parallel lines, which may be drawn between it and the vertex of the arch; and this species is sometimes named a *horse-shoe arch* from its fancied resemblance to that form. When the extrados of an arch, or the upper line of the voussoirs, is concentric with the intrados, (that is, the archstones being all of the same length,) the arch is then said to be *extradosed*.

Straight Arch. An arch of an intermediate form between the semicircular and gothic arch, consisting of straight lines and a pointed top, comprising two sides of an equilateral triangle: this was in use in Italy in the ninth and tenth centuries, and appears on the coins of Berengarius.

Gothic or Pointed Arch. That formed by the intersection of two arcs, and used in the buildings of the latter period of what is generally called the middle ages. It had a great variety of proportions, as it is found to have been struck on different occasions —from a third of its width,—from one-fourth—one-fifth—two-fifths —one-sixth—one-seventh—two-sevenths—three-sevenths—one-eighth — one-ninth—two-ninths and five-twelfths—but that constructed on an equilateral triangle is the most usual.

"By tuscan writers," says sir Henry Wotton, "they are called *di terzo*, and *quarto accuto*, because they always concur in an acute angle, and do spring from a division of the diameter into three, four, or more parts at pleasure: such as these, both for the natural imbecility of the sharp angle itself, and likewise for their very uncomeliness, ought to be exiled from judicious eyes, and left to their first inventors—the Goths or Lombards, among other relics of that barbarous age." Evelyn calls them *gotiq*. Modern architects have classed their varieties chronologically, according to the period in which they were first used in mediæval buildings.

Romanesque Arch. In decoration. A semicircular or a surbassed arch removed from its native position between the columns, and raised above them, or upon them—sometimes springing from the abacus of the capital, or from the cornice of the entablature.

History of the Arch. Notwithstanding the great importance of the arch in building, and the changes which its use has introduced, as well in the style and taste of decoration as in construction, the era of its invention, its original form, the name or country of its inventor, are involved in the deepest obscurity.

The shadowing wings of the cherubim meeting over the ark of the covenant, and the meeting of the branches of the palm-trees, with carved and gilded representations of which the walls of the temple of Solomon were adorned, have been cited by some authors of warm imaginations, and familiar with the mediæval structures, as suggesting the idea of a gothic arch. Yet it is remarkable that in the detailed description of this magnificent fane, no contrivance similar to the arch appears to have been employed in its construction. In the immense palaces built by the same prince in Jerusalem, and in the forest of Lebanon, (which required thirteen years to complete them,) the walls were formed of immensely large stones, generally 12 to 15 feet long, the *covering above* being of *cedar beams*, upon rows of cedar pillars. In the account of these buildings we find staircases regularly formed, but no indications of arches.

In the second temple built by Esdras, the temple itself, as well as the stately cloisters surrounding it, the apertures were of the lintelled kind; and when it was re-edified by Herod, the greatest part of these ambulatories are again described to have been roofed with beams of wood laid across, and resting upon massy stone pillars.

And it is not a little extraordinary circumstance, that there is no word at all of a similar import with the word arch, or its formation, from one end of the scriptures to the other, except in Ezekiel, where it is said, and "there were narrow windows to the little chambers, and to their posts within the gate round about, and likewise to the *arches*, and windows were round about inward, and upon each post were palm-trees"—which in the marginal emendation is made *galleries;* and where the same word which is here translated arches occurs in two other places, it is there translated *post.*

In Homer's description of the palace of Priam, a square court is surrounded by a portico with pillars and (rude) entablatures all round it, much like those ancient remains lately described as existing in Egypt, behind these were ranges of chambers 10 or 12 feet wide; but no mention is made of vaulted apartments, nor does the word occur in his poems.

He mentions the hundred gates of Thebes, which may probably be the identical structures remaining to this day. Each gate we find is generally composed of two great towers, like truncated pyramids, with their bases widely extended in proportion to their summits, standing at a little distance from each other, whilst the space between the portal is formed of a vast lintel, placed at a considerable height above the ground, from pyramid to pyramid, and covering a passage of sufficient height and width to form a magnificent gate. Each of these pyramidal towers contained several small apartments in each story, and piled on each other sometimes to the height of five or six stories: some of these towers are also filled up *solid*; but the opening between them is always covered over in the same manner. The palaces and temples are constructed of vast pillars of granite or marble, on which rested enormous imposts; these served as a sort of beams, upon which other great stones were placed like rafters, side by side, and which formed the roof, and occasionally the floors, of other superstructures: some of these stones, still to be seen, are 40 feet long.

In the pyramid of Sahara, a chamber 22½ feet long, and 12 feet wide, has the appearance of a high arched vaulted ceiling; yet, in reality, nothing can be further removed than this inclined roof from the construction of an arch of any kind; all the stones are laid in horizontal courses, each course projecting about 5 inches beyond that beneath it, until the two sides nearly meet, when the ceiling is completed by being covered with a flat stone. The great gallery of the pyramids at Memphis is 154 feet long, 26 feet high, and not more than 6 feet wide; its ceiling is formed by seven tiers of stones projecting in the same manner, each course 3 inches beyond that on which it is incumbent, till the two sides approach to within about 3 feet at top, and then it is covered with a flat stone. The great chamber in which the sarcophagus was placed, is 34 feet long, 17 feet broad, and 19 feet high: here a vault or arch would have been particularly beautiful as well as convenient. It is, however, roofed in the manner of one or two very narrow galleries in the same building, by nine immense stones laid from side side, and flat ceiled.—This was built twelve hundred years before the birth of Christ.

Herodotus, in describing the celebrated labyrinth, says it enclosed twelve courts, all of which were covered, or rather the porticoes, or ambulatories, which surrounded them, as he says farther on, that to each court was a peristyle (or space enclosed by pillars) of white stone very nicely adjusted, and the covering of every one of them was of stone, and considering the meaning of the word *(orophe)* he employs on this occasion, this covering was flat, like that in the great chamber of the Memphian pyramid. In part of this labyrinth, still remaining, the outward wall is built sloping (or battering) inwards like a pyramid; and also one of the larger and better rooms is actually covered with large stones laid from wall to wall as in the chamber of the pyramid.

The sekos, or interior of the temple of Isis, consists of several apartments, all the walls and ceilings of which are in the same way covered with religious and astronomical representations; the roofs are, like the rest remaining in Egypt, flat, having oblong masses of stone resting on side walls, and when the distance of these is too great, one or two rows of columns are carried down the middle of the apartment by which the roof is supported. These apartments are lighted by small perpendicular holes cut in the ceiling, and where it was possible to introduce them by oblique ones in the sides; these are very small on the outside, and gradually diverge for the purpose of dispersing the light over the apartment.

The conclusion is obvious, that the Egyptians, if not ignorant of the mode of covering a space by an arch, at least they did not resort to it; in fact, the knowledge or practice was unnecessary, when they possessed quarries capable of furnishing such enormous masses, and the means, both mechanical and economical, of raising them, seemingly of any dimension they wanted; that which is in a great measure a substitute for the insufficiency and imperfection of materials, would be to them an useless art. An architect who had the means of covering a room with nine large stones, would not surely employ a hundred for that purpose.

In this step of the inquiry, however, there is no historical data to go upon, as to whether buildings of less pretension than pyramids, and temples, and palaces were constructed with a similar regard (comparatively) to duration or stability; or whether that if an Egyptian gentleman constructed a dining room, or bedchamber of an equal dimension with that of the sarcophagus chamber in the pyramid at Memphis, that he would cover it with granite; the probability is against the conjecture that he would. But the general wants of the climate point out the use of flat roofs, or terraces. No remains of ancient Egyptian domestic architecture are extant, to enable us to decide, whether that invention which does not appear in any of the public buildings, might have been found in those edifices, where economy was a primary consideration. It is somewhat out of the proper place, but it is worthy of remark, that in a much later age, (that of Hadrian,) lintelled apertures in buildings, under circumstances in which we would the least of all expect to find them, were used by the Egyptian architects. In one of the *gates* to Antinopolis, composed of a centre apartment and two side ones, all three of considerable elevation and width, and decorated in the Greek style, the apertures are *lintelled*. The composition, though characteristic, and probably pleasing to an Egyptian eye, could not have been the production of a Greek or Roman artist.

It is on account of the absence of the arch in these buildings, that its existence in upper Egypt before the time of the Ptolemies has been questioned.

The ancient buildings of India bear a striking resemblance, in their general form, as well as in their solidity, with those of Egypt. The pyramidal gates of the latter bear a striking affinity to those remarkable erections over the gates of some of the more ancient pagodas and choultries particularly those constructed over one lofty pyramidal tower. In the ancient Hindoo choultries, the massy roofs of stone are quite flat, and supported upon vast pillars, and very nearly in the same manner with the ancient Thebaic temples,; and in some ancient Indian pagodas, the attempt to procure an inclined ceiling has been made by making one course project over the other, as in the gallery of the pyramid, and the space at the apex is covered with a single flat stone.

The Babylonian builders have also been considered to have been acquainted with the properties, and to have availed themselves of the use of, arches in their edifices. The bridge over the Euphrates, the hanging gardens, and the *subterranean passage* made by queen Semiramis under the bed of the Euphrates, are cited in support of the conjecture.

Herodotus describes the great bridge across the Euphrates to have been built with stone piers, (the stones being bound together with lead and iron,) upon which were laid, *(eula pepragona)* squared beams, so that it was a wooden framing on stone piers. The subterranean passage by which this queen passed from the old to the new palace, differed nothing in the construction of its ceiling from Egyptian practice. "Having turned the river," says Diodorus, "she formed from the palaces on each side a great trench, and built *(tas kameras)* covered ways of dried brick; on each part, she placed melted bitumen, till on each side the thickness of the layer was equal to four cubits. The walls of the breach on the sides were of the breadth of 20 feet, (i. *e.* thick,) and the height, exclusive *(kamphtheises psalidos)* of the inclined *forceps* part, (or of the sloping sides of the vaulting,) was 12 feet, and of the clear passage 15 feet." The investigations of recent travellers almost put the matter beyond a doubt, as to the mode of covering subterranean ways among this people. Rennel mentions a fragment of a subterranean canal, which, instead of being arched over, was covered with flat pieces of sand-stone, 6 or 7 feet long, by 3 feet wide; and Rich (Ruins of Babylon) explored a subterranean passage "walled with large bricks laid in bitumen, and covered over with pieces of sand-stone a *yard* thick, and *several* yards long." In another place he dug into a shaft, or hollow pier, 60 feet square, lined with fine brick, laid in bitumen, and made a way into a passage 10 feet high, *flat* on the top, and exhibiting both burnt and unburnt bricks, the former with inscriptions on them, and the latter as usual laid with a layer of reeds between every row, except in one or two courses near the bottom, where they were cemented with bitumen. And in another part, where an excavation was made, "a subterranean passage was found floored and walled with large bricks laid in bitumen, and covered over with pieces of sand-stone a yard thick, and several yards long; the weight on which being so great as to have given a considerable degree of *obliquity* to the passage." This is the same as described by Rennel, and the addition by Mr. Rich is curious, the obliquity being probably the original, instead of an accidental form, given to shorten the bearing of the ceiling stone. At the spot he examined it, the passage was only 7 feet high; but, a little farther on, the Arab guide informed him a horseman could ride upright in it. From an attentive examination of these remains, he concludes that there are the strongest grounds for supposing that the Babylonians were entirely unacquainted with the arch, of which he could not find the slightest trace among the ruins; and that the place of the column in their buildings appear to have been supplied by thick piers, buttresses, and pilasters.

That which has been described as a surprising and laborious experiment, was a strain of complaisance in king Nebuchadnezzar to his Medean queen, who could never be reconciled to the flat and naked appearance of the province of Babylon, but frequently regretted each rising hill and scattered forest she had formerly delighted in, with all the charms they had presented to her youthful imagination. The king, who thought nothing impossible for his power to execute, and that nothing ought to be unattempted for the gratification of his beloved consort, determined to raise woods and terraces, even within the precincts of the city, equal to those by which her native country was diversified.

The great *gates* of Babylon we may also consider to have been square headed, for Diodorus describes them to be "all of brass, even their posts and upper *lintels* also." "The whole pile," says Diodorus when describing the celebrated hanging gardens, "are of a square form; the roofs (or floors) or tops of the cavities in the mass were covered with beams of stone, whose length, including that part resting on the side walls, was 16 feet, and their breadth 4 feet. The structure resting upon these stones was composed, first of a layer of reeds mixed with much bitumen, then with a double layer of bricks, cemented together by plaster; and thirdly, of a cover of thick sheets of lead that no moisture might penetrate, and over these was laid such a thickness of earth as should be sufficient for the roots of the largest trees. And Strabo's account is essentially the same. The whole surface so elevated, was not of very great extent—not more than the area within the rails of Lincoln's Inn Fields, and less than that covered by the base of one of the pyramids; and about equal to that of the Isola Bella, in the Laggio Maggiore, to the arrangement of which these gardens have been likened.

The bridge over the Euphrates had the intervals between the piers covered with planks with *squared beams.* "The constructor of it," according to the same ancient historian, "hewed out very long stones; and about the middle part of the city, with those stones which he had dug out, he built a bridge, binding the stone together with iron and lead, and upon it he laid squared beams of timber, on which the Babylonians had a means of passing over. But in the nighttime these beams were taken away, and on this account, that persons wandering in the night might not steal from others on the opposite side." This offers no example of the arch, although it certainly may be considered as one of the earliest instances of a permanent *draw-bridge*, from the breadth of the Euphrates at Babylon, it is unlikely that *all* the flooring was taken up: probably, only over an interval of each end.

In the ruins of Persepolis, conjectured to have been part of the magnificent edifice that was destroyed by Alexander the Great, there is no indication of the springing of an arch, nor so much as an arched doorway, or window, or portal, in the whole edifice, nor even an arched niche. They are all, whether of larger or smaller dimensions, covered flat at top by imposts and architraves, or transom stones, or else hewn out of one single stone, but still of the square or oblong form. The peristyles of its rows consist of massy stone pillars, supporting architraves, or transom stones, and obviously intended to support only beams of timber.

The grand *false portals* of the excavated tombs next Nazi Tustan, are formed at top with flat lintels, and the pillars in front of the whole, though merely hewn out of the face of the solid rock, are purposely made to appear as if they supported great projecting imposts, with a long architrave and frieze above, adorned with sculptured figures. The general style of these productions nearly resembles that of Egyptian buildings. If this resemblance, added to the account of Diodorus, that they were erected by Egyptian artists, be received, it is probable that they were begun soon after the return of the army of Cambyses, probably by Darius, the son of Hystaspes, and finished by Artaxerxes, about the period of rebuilding the second temple of Jerusalem.

The remains of ancient buildings at Pæstrum, are constructed in a manner precisely similar; immense stones are laid on pillars, and over these others are placed to form the ceiling of the peristyles. There are no arches to be found throughout, nor any signs for the springing of an arch.

The use of the arch in Greek building, has been inferred from some descriptions (by Pausanias) of buildings of acknowledged antiquity. In particular, the mode in which he says the treasury of Mengas was constructed. It is probable, however, that he did not understand the principle on which they were reared: from his account of that at Orchomenas, he conceived they were built upon the principle of an arch. The remains of it, however, still existing, show it to have been formed by *projecting horizontal courses*, (not radiating ones,) having had their lower angles cut off, giving the structure an appearance of a gothic dome.

The whole of the Mengasian treasury has fallen into the level of the entrance; of this the entire height is about 7½ feet above the present level of the grounds; its breadth at top is 8 feet, and widens towards the bottom to about 9 feet; but the entire height of the opening is about 19 feet. The whole building is of white marble. Its lintel, or architrave, is flat, and composed of a single block 15 feet 4 inches long, 6 feet 3 inches broad, and 3 feet 3 inches thick, weighing nearly 24 tons. It must have been brought from a great distance, as the nearest quarries of white marble are those of Peutcliton; it has been about 65 feet in diameter.

In the island of Sardinia there are several edifices of the highest antiquity, called Noragis, which are constructed on the same plan, and in the same form with the ancient Greek treasuries, but they are not so large. According to Pausanias, Norax, with a colony of Iberians, built a town in Sardinia called *Nora*. These buildings may have been so named from this leader.

The treasury of Atreus, near Mycenæ, is still perfect, and may be considered as probably the most ancient Greek building in existence; it is only slightly mentioned by Pausanias, and it accords perfectly with his description of that of Minyas. A space of 20 feet in width between two walls leads to the entrance, which is 9½ feet wide at the base, and 7 feet 10 inches at the top, and about 19 feet in height, and leads by a passage of 18 feet in depth to a subterraneous circular chamber, built in the form of a gothic dome, terminating at the top in a point or key-stone. The cavity of the apartment is similar to that of a bee-hive.

There was an ancient temple of Apollo, at Delphos, which was said to have been built by bees, probably in allusion to the form of the hive in which it was constructed, like that which we are now describing.

The stones are of the hard and beautiful breccia, of which the neighbouring rocks, and the contiguous three-topped Mount Eubora consists. It is the hardest and most compact breccia in Greece, and resembles the rare antique marble called breccia tracagnina antica, which is sometimes found among the ruins of Rome.

The present height of the treasury is 49 feet, (50 feet, Gell.) from the present ground, level to the apex; as the floor is raised above its original line, the entire height is somewhat more. Its present diameter is 48 feet, (47 feet 6 inches, Gell.) which at the original level of floor, will of course be somewhat more. The blocks are placed in parallelograms, and regular layers, thirty-four ranges being at present visible. They are united with the greatest precision, without the aid of cement, and the stones are not all of equal dimensions; but the courses are generally about two feet in thickness, though they have the appearance, to a spectator, on the floor of diminishing towards the vertex, which may be the effect of the perspective.

This treasury, see engraving marked "History of Arch," had two chambers; a door leads from the first into the second, which is a square of about 27 feet, and about 19 in height in its present state, but its walls are not visible from being obstructed with earth. The door is only 9½ feet high, the base 4 feet 7 inches, and 4 feet 3 inches at top. It has a triangular cavity over its lintel, similar to that over the entrance to the great chamber.

These triangular stones were of enormous dimensions. The triangular stone on which are sculptured the "Lions" over the gate of Mycenæ, is 11 feet broad at the base, 9 feet high, and about 2 feet thick.

The outside front of the great chamber, which is the only part not covered with earth, faces the Acropolis. Over the lintel of the entrance is a triangular niche, at present open and unadorned, but which, in a more ancient period, was occupied by some embellishment. Its height is 12 feet, and breadth 7 feet 8 inches. Some masses of *rosso antico,* covered with spiral ornaments, and a columnar pilaster and its base, are seen lying near the gate, which may have been placed as a sepulchral stelo in the middle of the triangular cavity, and the sides filled with other ornamental or allegorical subjects. The pilaster and base are of a soft green stone, singularly enriched with spiral and zig-zag ornaments of an Egyptian rather than Grecian character: indeed the whole edifice has so much the appearance of Egyptian origin, that it was very probably constructed by the colony of the Belides, after the expulsion of the Inachidæ from the Argolic territory.

The thickness of the wall of this extraordinary structure has not been ascertained. The concave surface has been formerly ornamented with some interior decorations, as a great many long bronze nails are found fixed in the stones, even up to the summit of the building; they have large heads, and project about a third of their length beyond the surface. The lintel of the door is composed of two masses of stone, the largest of which is 27 feet long, 17 broad, and 3 feet 9 inches thick; the weight of which must be equal to one hundred and thirty-three tons.

No masses, except those of Egypt and Balbec, can be compared with this gigantic lintel, which is, however, of the same stone with the other parts of the building. The second lintel is of the same height, and probably of the same length, as the other; but as it is on the outer part of the edifice, and its extremities covered with earth, its length has not been ascertained; its breadth is only one foot. The exterior of the lintel is ornamented with two parallel mouldings, which are continued down the jambs of the door, in a similar manner to the portal of the temple of Bacchus, at Nasos.

All these subterranean chambers in Greece, Italy, and Sicily, were probably constructed upon the principle of the pyramids to which they have a considerable approximation, and have formed the primitive cryptæ of the chiefs of the people of antiquity. The triangular space over the lintels in these buildings, has been thought to indicate a rude attempt to relieve the centre of the stone from the inserted weight, and to throw it upon the ends. The conjecture is ingenious, and also an extension of it, as accounting for the employment of two stones spanning the opening over a lintel and meeting in a point, (see *fig. c.*,) and seen in the pyramids, and which are thought to be the origin of the pointed arch at least, but it is obviously without much foundation. That some sort of *ornament* was placed in their situations many ancient remains still testify; the gate of the lions, within a few hundred yards of this building, which bears marks of being of the same age, is an example. Here ornaments, conjectured to have alluded to the solar worship of the Persians, are placed in a similar *pointed* aperture; the *triangular* form, therefore, which was given to the entire ornament, fitting into the triangular niche, may have been in allusion to the (mudros) conic emblem of the sun.

It was certainly a mysterious figure among the Egyptians.

This species of adoration was possibly introduced into Argolis by the early Egyptian colonists, and an aperture in this form may therefore be considered rather as having been made from religious or mythological custom, than from any knowledge of the use or attempt at forming an arch; and in situations where it does not appear to have been intended to receive any embellishment, the same space was filled up by stones having an inclined position, and enclosing others fashioned in the triangular form.

The galleries in the walls, which anciently enclosed the Acropolis of Tiryns, offer other remarkable points in the history of the arch. The enclosure has already been described. (See *Acropolis.*) Here the vaulting only of the gallery need be noticed:—the gallery is 5 feet wide, the sides of it are formed by two courses of stone, and the ceiling by two other courses, on each side each project till they meet; the roof is *pointed* when seen from below, the lower end surfaces being cut in an angle of forty-five degrees; towards the east, that part of the gallery at present accessible, has six apertures opening towards the gallery. These openings are also in the pointed form, and formed by the horizontal row of stones on which the two courses forming the roof rest, being rudely cut into the form of a pointed arch, each stone meeting in the centre. This is unquestionably the nearest approach to an arch which has been noticed, and the difference in the construction between the soffits of this Cyclopean arcade, consists in the opening of the arcade, (if this term is allowable,) being formed by cutting the stone at each side, as *per figure*, and the angles of the two projecting courses in the other.

The gallery, it has been stated, is not more than 5 feet wide; and many of the stones which form its walls are of that form, for instance, which is described by Tacitus, as being in use in his time for the tents of the inhabitants of Arabia.

It was not, therefore, from a want of materials to form a *flat* roof to the gallery, or *lintels* to the apertures of the arcade. Some of the stones of the latter, which are cut to form the opening, would be more than efficient for a lintel; and the same thing is the case with the stones of the ceiling of the gallery; yet the enclosure is made by projecting stones, instead of by a stone rafter or beam; while the simpler mode was not only more convenient, easier in execution, and, of course, less expensive; and it must have occurred to the experience of those who appear to have built so much and so well, that lintels would have been equally strong, if not more so. This is a remarkable series of circumstances. The arrangement cannot by any possibility be considered as forming an arch, or as an attempt even at its construction, by those whose practice might have given them an indistinct glimpse of some of its more obvious properties. Was it therefore mere imitation that prompted its adoption in the walls of this fortress, and if it were, could its type be seen any where except in Egyptian buildings, in the gallery of the pyramids? or was it introduced with a reference to some mythological rite, or some religious observance?

The ancient buildings of Pæstum are probably of a somewhat later age than those which have just been described; they are, without an exception, constructed without any use of the arch, or knowledge of it. In the city walls, as drawn in Mayor's book, there appears an arched gateway; but an accurate examination has shown that this aperture was an alteration in a much later age.

In the ruins of the temple of Diana, at Ephesus, built after the time of Alexander, some remains of arches have been discovered by recent travellers; but we know that this edifice was repaired by both Trajan and Adrian, from inscriptions remaining on the building itself; and it is not probable that Pliny, who expressed both wonder and admiration at other parts of this wonderful structure, should have omitted all notice of an invention which would have made it still more so.

The foundation of this building was laid in a marshy soil, by means of layers of pounded charcoal, and alternate pieces of wool, and on this was placed a most solid basement, a construction which manifestly precludes all idea of arches being used by the builders.

"Just," says Pliny, "is the admiration of the magnificence that the temple of Diana at Ephesus excites, which was two hundred and twenty years in building, at the expense of all Asia Minor. In a marshy soil they placed it, that it might not be affected by earthquakes, or subject to any rendings; and further, that they might not lay the foundations of such a vast pile upon a yielding unstable bottom, they formed a stratum of pounded charcoal, covered with fleeces of wool; the length of the whole temple was 425 feet, the breadth 220 feet, the columns one hundred and twenty-seven, made at the expense of individual kings; the height of them 60 feet, and thirty-seven of them sculptured, one by Scopas. Chersephron, the architect, presided over the work."

It was most miraculous that architraves of such immense bulk could be raised up to their places. This he accomplished by means of bags full of sand piled up, forming a gentle ascent, rising higher than the capitals of the columns, and then by gradually emptying the lower ones in order that the work in hand, the ponderous mass, might slowly, by little and little, settle on its proper support. This was brought to pass with the utmost difficulty, with regard to the very *lintel* which he was placing upon the portal, for its bulk was most prodigious, and it did not settle properly on its support or bed, in consequence of which, the architect, full of anxiety, was ready to doom himself to death.

Tradition says, that wearying himself out with such thoughts in the night he saw in his sleep the goddess whose temple he was building, appearing to him, and exhorting him to live, for that *she* had set the stone right; and so it appeared the next day, seeming to have been brought to its correct position by its own weight. The anxiety of the architect, and the interposition of the goddess would neither have occurred, had the simple means of suspending an architrave, now employed, been known at Ephesus.

The earlier temple may also be considered to have been likewise a *lintelled* structure.

The first positive information that occurs in historians regarding the use of arches is given by Livy, who informs us that Scipio Africanus, and Lucius Mummius, placed arches on piers, which had been formed by M. Fulvius some years before that period, about one hundred years before Augustus Cæsar was placed in the empire. And Cicero, in his oration against Verres, mentions an arch, erected in honour of Verres, at Syracuse, "and so early an existence of such a kind of structure *there*, before we read of any thing like it any where else, may fairly lead us to suspect that Sicily was the country where this noble kind of ornament first appeared, and that, indeed, Archimedes was the inventor of it."

Hirtius describes arches at Alexandria; Livy also particularizes a street called the *archway* at Rome; and Virgil has a plain reference to arches in some of his ideal descriptions and similes; yet all these were after the era of Archimedes.

Aristotle's simile of the works of God to the stones of a vault, *(peri kosmon,)* is said to be spurious. The words of Plato, recommending a long vault as a monument to the chief magistrate, may be translated as a vault similar to that of the treasury, so called, of Atreus.

The arches of the aqueduct of Aqua Martia were constructed by the consul, and the aqueduct first begun by Ancus Marcus, cannot be shown to have been other than a water course, at most an excavated tunnel.

Dr. Clarke mentions an ancient barrow at Temrook, which encloses a large arched vault. The stones of the sides are all square, perfect in their form, and put together without cement, and the roof exhibits a fine turned arch having the whiteness of the purest marble. An interior vaulted chamber is separated from the outer, by means of two pilasters swelling out towards their bases, and placed one on each side of the entrance, the inner chamber being the larger of the two. He also mentions an arched passage annexed to the fountain of Hippocrates, near Cos, which he supposes may be of the age of that physician, and likewise a tomb at Telmessus, which he thinks affords a satisfactory proof of the existence of arches before the christian era. Of any of these specimens the age is purely conjectural.

The *Cloaca Maxima* in Rome, from the express testimony of ancient writers, was constructed by Tarquinus Priscus, and perhaps completed by Tarquinus Superbus. There is no allusion to this work until after the Gauls were expelled from the city, when Rome was reduced to a deplorable and ruinous condition. Materials for its reedificàtion were gratuitously furnished by the people, and the city suddenly again rose into importance, each choosing the spot for his habitation that he fancied without any reference to a uniform plan.

During the time of Cato the Censor, they are again noticed. Others were formed in the Aventine and other places where they had never been before, but these never could have been connected with the more ancient ones. This repair was done at the expense of a *thousand talents*. Hence, to the reign of Augustus, a period to which many of the most distinguished works of Rome may be referred, the Cloaca Maxima is not again mentioned until it was cleansed and repaired by M. Agrippa, who, besides, constructed others, and connected them by means of lateral pipes, which he laid into the houses of individuals for the purpose of taking off the waste water. And Aedile, as we are told by Strabo, caused seven rivers, by guiding their streams, to run through the Cloaca into the Tiber, so that Rome was said to be pensile and navigable underneath.

Strabo says, as to the sewers, covering them over arch-wise with stone squared and well fitted, they left ways therein, some of them sufficient for the passing of carriages laden with hay; and he adds, after an enumeration of other particulars in these things, the chief care was bestowed by M. Agrippa; and it is curious to observe the feelings of the horror of such an employment.

The draining of the marsh, now known by the name of Velabro, appears to have been the intention of Tarquin, and keeping the river within certain limits by a massive quay of stone, through which the water was conducted. This sewer served not merely for the purpose of carrying away the filth of the city, but to collect and cut off the springs which percolated from the interior of the Palatine hill, and the equally important office of conveying the rain from the heights, which, in that part of Italy, frequently for days together falls in torrents, and which, by flooding the plain below, would have caused a morass.

The Cloacæ were, at the period of the expulsion of the Gauls, led through *public places*, but after that period houses were built *upon* them.

Livy resided many years at Rome during the reign of Augustus; he was then employed in the composition of his history, which he occasionally read to the emperor, who was anxiously solicitous about the decoration of the capital. From the well-known jealousy of his character, Livy durst not have assigned a work like the Cloaca Maxima to Tarquin, which he declared yielded not in point of magnificence to any of recent construction, could he have given the merit of it to the son-in-law of his patron. Besides, could Agrippa have uncovered this ancient channel, and closed it with arched masonry forty-three palms in width? an undertaking, which implies the removal of all houses over it, through one of the most populous districts of the city? Nor would Pliny, when contemplating the wonders of the city, the agger of Tarquin, have pronounced that the Cloaca had continued eight hundred years, "prope inexpugnabiles," had they been formed within a century of his time.

The actual commencement, and the course and termination of the Cloaca Maxima, correspond nearly with what has been considered to be the most ancient limits of the city. It had its origin very near to the site of the arch of Severus, then under the Bia Sacra, to the temple of Juliûs, and turned under the Bia Nova, by the side of the Palatine hill, to the Forum Boarium, which it crossed, and, proceeding in a straight line, reached the Tiber, opposite the temple of Vesta, a distance of not more than two thousand five hundred palms, or about a third of an English mile:—it is about 16 feet broad and 30 high.

In opposition to this opinion, it has been urged that we have no positive testimony of the Cloaca Maxima having been provided with a covering of any kind. Before the period of the expulsion of the Gauls, the Cloaca was led through the public places; but when the city was restored and rebuilt by Camillus, and each citizen chose the spot most agreeable to himself, the houses were crowded together in narrow crooked streets, and some of them were even built upon the Cloaca Maxima

Livy says, "this is the cause that the ancient sewers first carried *along* the public ways, now pass *under* private houses." But it would be too much to expect, that had the sewers been covered before that event, that a similar appropriation would not have been made.

In fact, the expression of Livy when describing the labours of Tarquin, evidently refer to *mining* rather than masonic operations. His account of the aversion of the Romans to the employment, may have been derived from tradition, and is curious as a picture of the *difficulties* of ancient builders.

When Tarquinus Priscus was performing that work by the hands of the people, and it was uncertain whether the excessive danger or the length of the labour would be greatest; and where here and there Romans were found avoiding the dreadful toil by voluntary death, that king found a new remedy unthought of either in preceding or after times, which was to fix the bodies of all who so died upon the cross, as spectacles to the citizens, and at the same time to be torn by wild beasts and birds, by which means the proper revering of the Roman name, that so often has saved lost affairs in battle, came in aid, while moreover at that time he imposed the effect of now, as it were, blushing for them, as shaming only the dead, when in reality he shamed only the living.

The re-covering of the sewers in these cases, was probably the same as the superstructure, wood.

That part of the city through which the sewer was led, it is admitted, was among the most populous in Rome, and it is exceedingly improbable that Agrippa did remove all the buildings with which it might be covered in order to repair it. Yet it is equally improbable that all the buildings so placed in his time, were the erections of the age of Camillus. Portions of these might have been covered with stone before his time, in the process of reedifying the superstructure. It was the boast of Augustus that he found Rome of wood, but he would leave it of marble; and if any part of the city over the Cloaca was included in his magnificent antithesis, the sewer on which the house stood, it might have been found necessary, even during that period, to make of corresponding stability with the house of marble, to arch instead of flooring it. The Cloaca Maxima, for example, was carried under the Pantheon, built by Agrippa. Could its magnificent builder avoid reconstructing it in that part which he had selected for the site of this immense edifice? yet this was nearly an eighth part of the whole length of Tarquin's *built* work. When the city was destroyed by Nero, many other parts *must* have been subjected to the same sort of reparation.

As to the expressions of Roman and Greek historians regarding the magnificence of Tarquin's work, they can be reconciled to probability, if not to truth, without at all implying a knowledge existing in those remote times of the construction of an arch.

The style of Etruscan building is that of massive greatness, often surpassing apparent necessity, and so compact that it might sometimes be mistaken for a uniform substance. The sides and bottom may have been in this style, and merit all the encomiums which have been heaped on the excellence and durability; while the mere connecting of the side walls by an arch of equal or greater solidity, could not be considered, in aftertimes, a work of that magnitude and importance as to have preserved the name of the builder who constructed it, even supposing, that the whole length had been so enclosed at *one* time; for in fact, considered with reference to its size, when compared with the Pantheon, to the Coliseum, and many other buildings, the Cloaca Maxima was an insignificant work. An arch 1400, or 1500 feet long, 16 feet wide, and 30 feet high, was not more than equal to the *one* of the arcade of the Coliseum.

On the antiquity of the Cloaca Maxima, the opinion of authors, drawn from a careful examination of their style, ought not to be disregarded; and the present sewer, acknowledged to be of the Roman, bears manifest marks of its having been the work of a period much later than the time even of Camillus.

The more ancient Roman buildings have no indication of arches. The temple of Vesta shows none even in its windows. The temple of Hercules and of Concord, both of high antiquity, do not enter into the construction.

The emissaries of the lake Albano, built during the siege of Veii, three hundred and ninety-four years before Christ, have stones projecting as in the earlier Grecian Egyptian examples.

The sepulchral tomb, called the Horatii, had no arch; nor that of Plautius. Of other Roman buildings referred to as exhibiting arches, the temple of Jupiter Tonans was rebuilt by Augustus, that of Romulus by Adrian, of Minerva by Pompey. The temple of Saturn, which existed in the time of Publicola, has been considered from the style of its ornaments to have been rebuilt at various times: the temple of Juno was restored by S. Severus.

The best authorities do not therefore trace the period of the introduction of the arch in Roman buildings higher than the time of Scipio Africanus; and that as there must have been some degree of contemporary knowledge existing among the Italians, from the intercourse of Greece with its colonies, it is probable that their knowledge of this invention was derived from this people, for arches do not appear to have been unknown in Greek buildings at the *time* of Alexander the Great, though very little use was made of them in the building of temples. "The Greeks only," says Visconti, "employed them in edifices of a certain kind, to which this form seemed indispensable. Such were the aqueducts, of which the arches (phalides) near to Argos were cut by Cleomenes; such was the theatre of Mitylene, the exterior arcades of which were probably imitated at Rome in the theatre of Pompey, which served in its turn as a model for that of Marcellus. It is not therefore impossible, that arches may have been employed about the time of Alexander the Great in the construction of a theatre, the first, perhaps, that was built of solid materials at Athens, for the purpose of entertaining the Greeks with the masterpieces of Sophocles and Euripides, and with the comedies of Aristophanes and Menander.

In coming to the same conclusion of the first appearance of the use of arch building being among the Greeks, other antiquaries fix the era somewhat later than Visconti.

That it was then and there invented we have, however, no means of ascertaining or deciding, or even that its properties were understood; for in this, as in other objects of human contrivance, from the most elevated to the most humble degree of practice, it is always found to precede theory; and the arch, originally the result of chance, might have been used without knowledge, and imitated without reflection. Till after the reign of Alexander, it has been remarked, there are no authors who use the words, afterwards employed, to signify the form of arch, in a sense, which can lead us to consider them as signifying an arch constructed on scientific principles; this has been employed when investigating its rise in other countries, but the inferences ought to be received with some caution. There are numberless operations and inventions when the science of definition is so well understood, and materials so abundant, almost of equal importance even in our own times, which have no equivalent expression in English, and which, as far as their descriptions in books might be adduced for their existence, have certainly no local habitation or a name. We cannot, therefore, expect to find in those ages a correct knowledge of its scientific principles, while in our own times the subject rests in all its original obscurity and uncertainty.

Arched. *adj.* Vaulted.

Arched-schene, or scheme. A

flat arch, less than a semi-circular one.

Arch-monastery. A name sometimes given to the greater monasteries and abbeys.

Arch-pillar. The main or principal pillar. A pier, which, among others, more immediately supports an arch or vault.

Arch-way. An aperture in a building covered with a vault. Usually an arched passage or gate, wide enough to admit carriages to pass under.

Archæographia. The art of describing or explaining antiquities.

Archeion. The most retired and secret place in Grecian temples, used as a treasury, wherein were deposited the richest treasures pertaining to the deity to whom the temple was dedicated; and also other valuable articles which the people of the city wished to preserve secure. The Romans, in imitation of the Greeks, lodged their public treasure in the temple of Saturn.

Archelaus. A famous sculptor, the son of Apollonius, born at Priæne, a town of Ionia. The celebrated marble monument of the Apotheosis of Homer is ascribed to him. It was dug up A. D. 1658, in a field belonging to the princes of Colonna, where, it is said, the emperor Claudius, in whose reign it was executed, had a house of pleasure.

Archeria. *In mediæval architecture.* Long narrow openings in city and castle walls, through which the archers shot stones and arrows upon the assailants.

Archibancus. *In mediæval architecture.* A cabinet. A wardrobe. A cupboard.

Archimedes. One of the most celebrated mathematicians of antiquity. He was born at Syracuse, according to Torelli two hundred and eighty-seven years, but according to Rivaltus, who has taken considerable pains in ascertaining the true æra of his birth, two hundred and ninety-one years, before the birth of Christ. Though living in habits of the most intimate friendship with Hiero, the Syracusan king, he prosecuted his studies with unremitting assiduity; and amongst various objects of mathematical speculation, to which his attention and inventive faculties were directed, one of the principal was the mensuration of the conic sections. "Unless," says the writer of this article, in Dr. Rees's Cyclopædia, "we except the lunes of Hippocrates of Chios, he was the first who squared a curvilineal space; he also reduced the quadrature of the circle to the determination of the ratio between the diameter and the circumference; and though unable to obtain the precise value of it, he assigned a useful approximation to it by the numerical calculation of the perimeters of the inscribed and circumscribed polygons. He determined the relation between the circle and ellipse; and likewise attempted the hyperbola, though from the nature of the case he was not likely to succeed. He also found the proportion of the area of the spiral to that of the circumscribed circle, and that of their sectors; he determined the relations of spheres, spheroids, and conoids, to cylinders and cones; and of parabolas to rectilineal planes, whose quadratures were already known. In all his mathematical investigations, he imitated the example of his predecessor Euclid; and, like him, he was cautious in admitting any principles that were not strictly geometrical and unexceptionable." Such was the pleasure he derived from having discovered the proportion between the sphere and its circumscribed cylinder, that, as a memorial of this discovery, he requested his friends to place upon his tomb a cylinder containing a sphere, with an inscription expressing the proportion of the one to the other.

The mechanical skill of this great man was, during the last eight months of his life, applied to the protection of his fellow-citizens. Syracuse being besieged by Marcellus, Archimedes devoted his time to the construction of such engines as would arrest his operations; and, according to Plutarch, whether the vessels of the enemy were nearer to the walls of the city, or more distant from them, Archimedes was sure to annoy them. When they approached the ramparts, he suspended long beams, (which probably acted like levers,) and struck the galleys with a force that sunk them; and by means of grappling hooks at the extremities of other levers, he raised up vessels in the air, and then dashed them to pieces against the walls, or projecting rocks. Independently of these, he used instruments which threw large stones, that demolished the ships or machines employed in the siege; and burning glasses, which set the ships on fire at a great distance from the city. Syracuse, however, was eventually taken; and though Marcellus had given strict orders that the house and person of Archimedes should be inviolate, he was surprised and put to death. Marcellus paid respect to his memory, by directing and superintending his funeral, and restrained the victorious army from offering any violence to his relations.

Archinale. See *Arsenal*.

Architect. One who designs and superintends the erection of buildings.

It is within the province of the architect to examine and see that the materials used by the different artificers in the construction of an edifice be of good quality; that the workmen proceed in their several departments, according to the plan he has given to them; and, when the work is completed, to measure and value the whole.

The qualifications necessary to constitute a good architect are many, and for the most part difficult of acquirement. He should conjoin practice and theory. Practice is the constant and accustomed attention to the manual operations, and to the several kinds of materials of which a work may be constructed: and theory is the ability to demonstrate and explain the rules and reasons of the proportions of buildings. Architects who have practised without theory, and who have been only experienced in the manual part, have never been able to acquire any reputation by their works; and those who have trusted to theory and speculation only, have followed the shadow and not the substance. An architect should be ingenious and ready to receive instruction; for neither ingenuity without education, or education without ingenuity, can render him a complete artist. He should have a knowledge of letters, that he may be able to ensure the remembrance of his observations; be expert in drawing, that he may be enabled to form the representation of the work he would execute; have a thorough knowledge of arithmetic and mensuration, by means of which the expense of an edifice is calculated, the measures adjusted, and the difficult questions of the symmetry solved; be learned in geometry, which greatly facilitates the delineation of the plans of buildings, and the management of squares, levels, and lines; be well acquainted with projection and perspective, that he may anticipate the appearance of the building he is about to erect, in one or more points of view; have some knowledge of trigonometry, which is useful in ascertaining the heights and distances of objects; be intimate with those departments of the mathematics which relate to gravitation, the composition and resolution of forces, and the properties of the lever; and know so much of chemistry as will ensure him a proficiency in the knowledge of the strength and properties of materials, and the best methods of connecting them together.

Besides these, he should study the aspects of the heavens, that he may admit the light to the best advantage; and so regulate the apertures of a building that the inhabitants shall be incommoded as little as possible by the extremes of either heat or cold. He should be well read in history, and conversant with the laws, at the least so far as relates to the rights and divisions of property, and the restrictions under which he is permitted to build. A knowledge of history is indispensable, that he may not make an improper choice in the selection of ornaments. For example, statues of women in garments, called Caryatides, are sometimes introduced in a building, supporting the mutules and cornice, instead of columns. If the reason for this be demanded, it may thus be given. Carya, a city of Peloponnesus, having joined with the Persians against the Grecian States, and the Greeks having put an end to the war by a glorious victory, with one consent declared war against the Caryatides. They took the city, destroyed it, slew the men, and led the matrons into captivity, not permitting them to wear the habits and ornaments of their sex; and they were not once only led in triumph, but were loaded with scorn, and kept in continual servitude, thus suffering for the crime of their city. The architects, therefore, of those days, introduced their effigies sustaining weights, in the public buildings, that the remembrance of the crime of the Caryatides might be transmitted to posterity.

The Lacedemonians, likewise, under the command of Pausanias, the son of Cleombrotus, having, at the battle of Platea, vanquished, with a small number, a numerous army of Persians, in order to solemnize the triumph, erected, with the spoils and plunder, the Persian portico, as a trophy to transmit to posterity the valour and honour of the citizens; introducing therein the statues of the captives, adorned with habits in the barbarian manner, supporting the roof. Hence it is, that Persian statues are sometimes introduced sustaining the epistylium and its ornaments. There are also many other historical facts, with which it behoves an architect to be well acquainted.

"Proficiency," says sir William Chambers, "in the French and Italian languages is also requisite to him; not only that he may be enabled to travel with advantage, and converse without difficulty, in countries where the chief part of his knowledge is to be collected, but almost to understand the many and almost only valuable books treating on his profession; the greater part of which have never been translated. And as among sea-faring men there is a technical language, of which no admiral could be ignorant without appearing ridiculous; so in architecture, and the professions connected therewith, there are peculiar modes of expression, and terms of art, of which no architect must by any means be ignorant; as that knowledge impresses upon the minds of the workmen a respectable idea of his abilities, consequently a deference for his opinions; and, furthermore, enables him to explain to them intelligibly, what he intends or wishes to be performed."

Having thus enumerated the principal qualifications necessary to constitute a good architect, it is very easy to conceive, that any one who wishes to excel in this profession must apply himself to study with the greatest diligence and attention; that he must learn to become a quick draughtsman, and to acquire taste in the selection of appropriate ornaments.

The most celebrated architects and writers on architecture, are Vitruvius, Bruneliske, Alberti, Bernini, Serlio, Scamozzi, Palladio, Vignola, Barbaro, Catano, Viola, Inigo Jones, De Lolme, Perrault, S. le Clare, Sir Christopher Wren, the Earl of Burlington, Sir William Chambers, and Peter Nicholson.

Architective. *adj.* That performs the work of architecture.

Architectonick. That which has the power or skill of an architect.

Architectonical. *adj.* Skilled in architecture.

Architectonical. That which forms or builds any thing.

Architector. A builder.

Architectress. She who builds.

Architectural. *adj.* Concerning, or relating to, architecture as a decorative art.

Architecture. The art of forming dwellings, or buildings of any kind.

It may be divided into two parts; the essential, and the ornamental. The first regards the real qualities of buildings, their convenience, strength, &c.; the other has relation only to their outward appearance, or effect. In the former respect, architecture ranks with those arts which relate to the necessaries and conveniences of life; in the latter, with the arts of entertainment, as poetry, painting, and music.

The history of architecture, like that of most other arts, is involved in obscurity. Nevertheless we may, by comparing the accredited histories of enlightened nations with the actually rude state in which some of the existing tribes of men are but too well known to be, draw a conclusion, that it originated from necessity, and has advanced towards perfection through a series of progressively improving stages.

In the earliest ages of the world, while as yet the earth was but thinly populated, it seems more than probable, that mankind dwelt in natural caverns in the earth, and in the hollows of the trunks of trees. As population began to increase, man, gifted with faculties susceptible of improvement, and possessed of a fondness for the companionship of his fellows, would mingle with them, and add some portion of their knowledge to his own experience. The pleasures he thus derived from the interchange of sentiment, conjoined to the strongest of all the impulses, that of self-preservation from the attacks of the larger kinds of animals, and from the villainous of his own species, might induce him to feel disgusted with those dark and miserable habitations, and influence a wish to adopt some mode by which he might remediate the evil. Unskilled as he then was, without tools to assist him in his labours, his first essay in architecture must have been extremely rude; and his hut, from our knowledge of the earliest attempts towards construction, as displayed in the comfortless habitations of many of the Indian tribes, doubtless must have been somewhat similar to the wigwams of the North American Indians, and kraals of the Hottentots and Caffres, of the present day.

Huts of this description are very easily constructed. A few boughs of trees, collected together and broken of a determinate length, are placed in a slanting position, resting against, and supporting each other at the top. The bottom, or lower part, of the boughs are then spread out, to admit the interior of the hut to be of sufficient capacity for the purposes of the intended occupant; and an aperture is left for entrance. Between the interstices of the boughs smaller branches, or twigs, are interwoven; and the whole is covered with clay, slime, or mud, to render it impervious to the weather, and to secure, as near as possible, an even temperature.

As ages continued to roll away, and mankind to increase and multiply, dissensions arose between different families, and sometimes between the members of the same family.

The bond of amity being dissolved, men separated into distinct tribes. Hence arose rapine, and violence, and murder. The people of the one tribe, anxious to preserve themselves from the depredations of the other, would seriously turn their attention to the erection of more stable edifices; and having observed, perhaps, the sharpness of a broken wedge-shaped piece of flint, would learn to make tools, cut down trees, and drive the lower parts of the trees, thus cut down, into the earth, to make themselves strong, convenient, square-shaped buildings, in lieu of those of a conic figure, which would not permit them to stand upright. Thus, from the primitive hut, or wigwam, civil architecture has, from various influential causes, advanced progressively to its present state of improvement.

Vitruvius, the most ancient writer on architecture, after a somewhat fanciful description of the first cause which brought mankind into a social state, informs us nearly as above, in the following words:

"Mankind began to make themselves coverings with the boughs of trees; some dug caves in the mountains; and others, in imitation of the nests of swallows, with sprigs and loam made shelters which they might lie under; and by observing each other's work, and turning their thoughts to discover something new, they by degrees improved, and made better kinds of habitations; but men being of an imitative and docile nature, glorying in their daily inventions, and showing one another the houses they had made, they, by these endeavours and exertions of their faculties, became in time more skilful.

"At first, for the walls they erected forked stakes, and, disposing twigs between them, covered them with loam; others piled up dry clods of clay, binding them together with wood;

and to avoid rain and heat they made a covering with reeds and boughs; but finding this roof could not resist the winter rains, they made it sloping and pointing at the top, plastering it over with clay, and by that means discharged the rain water.

"That the origin of things was as above written, may be concluded from observing, that to this day some foreign nations construct their dwellings of the same kind of materials; as in Gaul, Spain, Lusitania, and Aquitain, they use oak, shingles, or straw. The Colchians, in the kingdom of Pontus, where they abound in forests, fix trees in the earth, close together, in ranks to the right and left, leaving as much space between them as the length of the trees will permit; upon the ends others are laid transversely, which circumclude the place of the habitation in the middle; then at the top the four angles are braced together with alternate beams; and thus the walls, by fixing other trees perpendicularly on those below, may be raised to the height of towers; the interstices, which on account of the coarseness of the materials remain, are stopped with chips and loam. The roof is also raised by beams laid across from the extreme angles, gradually converging and rising from the four sides to the middle point at the top, and then covered with boughs and loam. In this manner, the barbarians made the testudinal roofs of their towers. The Phrygians, who inhabit a champaign country, being destitute of timber, by reason of the want of forests, select little natural hills, excavate them in the middle, dig an entrance, and widen the space within as much as the nature of the place will permit: above, they fix stakes in a pyramidal form, bind them together, and cover them with reeds or straw, heaping thereon great piles of earth. This kind of covering renders them very warm in winter, and cool in summer. Some also cover the roofs of their huts with the weeds of lakes; and thus, in all nations and countries, the dwellings are formed upon similar principles. At Marseilles we may observe the roofs without tiles, and covered with earth and straw. At Athens the Areopagus is an example of ancient roofs of loam: at the Capitol also, the house of Romulus, in the sacred citadel, may remind us of the ancient manner of covering our roofs with straw.

"By these examples, therefore, we may be assured that the first inventions of building happened in the manner we have related. But at length mankind by daily practice improved, and by repeatedly exercising their faculties and talents, arrived at the full knowledge of the art; those who were the most experienced professing themselves artificers. When, therefore, these things were thus far advanced, as nature had not only given to mankind sense, in common with other animals, but had also furnished their minds with judgment and foresight, and had subjected other animals to their power, they from the art of building gradually proceeded to other arts and sciences, and from a savage and rustic way of life became humane and civilized. Then, when their minds were thus enlightened, and they became more judicious by experience and the advancement of the various arts and sciences, they no longer built huts, but founded houses with walls constructed of bricks, stones, or other materials covering the roofs with tiles."

Having thus furnished the

reader with the probable causes which led mankind to pursue the art of architecture, it is not our intention, in this place, to endeavour to trace it through its successive changes, in the lapse of ages, or to delineate those events which have led to its rise and declension in various parts of the globe. That information will for the most part be given to him while describing the architecture of the various nations. Nevertheless, we shall here present him with a table, chronologically arranged, of the foundation of most of the principal cities and kingdoms of the postdiluvian world; as also of some of their most famous structures; and then proceed to investigate the *principles of architecture*, to which we wish particularly to draw the reader's attention.

B. C.
2247. The Tower of Babel built by Noah's posterity, in the plains of Shinah.
2221. Nimrod founds the Chaldæan monarchy.
2188. Menes or Mizraim, the son of Ham, lays the foundation of the Egyptian kingdom, which lasted 1663 years, to the conquest of Cambyses, 525 years before Christ.
2089. The kingdom of Sicyon established, which lasted 1000 years, terminating in 1088 B.C.
2059. The kingdom of Assyria begins: terminates 900 B. C.
1856. Commencement of the kingdom of Argos.
1718. Sparta built.
1575. Pyramids of Egypt built.
1556. Cecrops founds Athens.
1546. Scamander, from Crete, founds Troy, which was burned by the Greeks, on the 11th of June, 1184 B. C.
1344. The kingdom of Mycenæ begins: ends in 1104.

B. C.
1252. The city of Tyre built.
1233. Carthage founded by a colony of Tyrians.
1182. The kingdom of the Latins begins under Æneas.
1176. Salamis in Cyprus built by Teucer.
1152. Ascanius builds the city of Alba Longa.
1141. The temple of Ephesus destroyed by the Amazons.
1124. Thebes built by the Bœotians.
1104. Kingdom of Lacedæmon begins.
1044. The Ionian colonies migrate from Greece.
1012. Solomon begins the temple of Jerusalem: 974, plundered by Sesac, king of Egypt: 586, destroyed by fire: 515, rebuilt: 170, plundered by Antiochus: 19, rebuilt by Herod. A. D. 70, Jerusalem destroyed: 130, rebuilt, and a temple dedicated to Jupiter: 1023, the temple plundered by the Caliph of Egypt: 1031, began to be rebuilt by Romanus: 1187, Jerusalem finally destroyed by Saladin.
992. Solomon's palace finished.
986. Samas and Utica built.
974. Jerusalem taken, and the temple plundered by Sesac, king of Egypt.
869. The city of Carthage supposed to be built by Dido: destroyed by P. Scipio, 146: rebuilt by order of the Roman senate, 123.
814. The kingdom of Macedon begins: continues 646 years.
801. Capua, in Campania, built.
797. Commencement of the kingdom of Lydia: ended, 550 B.C.
753. Rome built: plundered by Alaric, A. D. 410.
732. Syracuse supposed to be built about this time by a

B. C.

colony of Corinthians under Archias.

713. Gelas, in Sicily, founded.

708. Ecbatana built by Dejoces.

707. The Parthians, on being expelled from Sparta, build Tarentum.

703. Corcyra built by the Corinthians.

665. The city of Alba destroyed.

658. Byzantium built about this time by a colony of Argives.

549. The temple of Apollo, at Delphos, destroyed by Pisistratidæ.

630. Cyrene built by Battus, who begins that kingdom.

538. Babylon taken by Cyrus, which terminates the kingdom.

539. Marseilles built by the Phocæans.

504. Sardis burned by the Athenians.

493. The Athenians built the port of Piræus.

351. The Sidonians, being besieged by the Persian army, burn their city. The monument of Mausolus erected.

315. Cassander rebuilds Thebes, and founds Cassandria.

304. Antioch, Edessa, Laodicea, &c. founded by Seleucus. Antioch destroyed by the king of Persia, A. D. 540: rebuilt, 542. The city of Antioch destroyed by an earthquake, 580.

291. Seleucus builds and peoples about forty new cities in Asia.

284. The Achæan republic founded.

283. The college and library of Alexandria founded.

267. A canal made by Ptolemy from the Nile to the Red Sea.

83. Sylla destroys the Roman capitol: 69 B. C. rebuilt: A. D. 80 destroyed by fire: it was again rebuilt and destroyed by lightning, A. D. 188.

55. Pompey builds a stone theatre for public amusements: destroyed by fire, A. D. 21.

27. The Pantheon, at Rome, built: destroyed by fire, A. D. 80.

19. The aqueducts, at Rome, constructed by Agrippa.

10. The city of Cæsarea built by Herod: destroyed by an earthquake, A. D. 128.

A. D.

18. Tiberius built by Herod.

50. London built about this time by the Romans.

56. Rotterdam built about this time

70. Jerusalem destroyed by Titus.

79. Herculaneum and Pompeii destroyed by an eruption of Mount Vesuvius.

80. Titus builds the hot baths and amphitheatre at Rome.

93. The empire of the Huns, in Tartary, destroyed by the Chinese.

114. Trajan erects his column at Rome.

121. A wall built by Adrian between Carlisle and Newcastle.

130. Adrian rebuilds Jerusalem, and erects a temple to Jupiter.

134. Urbicus's wall built between Edinburgh and the Firth of Clyde.

209. Severus builds his wall across Britain.

260. The temple of Diana burnt.

274. The temple of the sun built at Rome.

412. The kingdom of the Vandals begun in Spain; and in Africa, 439.

ARCHITECTURE.

A. D.

420. The kingdom of the French begins on the Lower Rhine.

449. The Saxons arrive in Britain. Ella founds the second Saxon kingdom in Sussex, 491.

452. The city of Venice founded about this time.

476. The kingdom of Italy begins.

510. Paris becomes the capital of the French dominions.

567. The kingdom of the Visigoths founded in Spain.

575. The first monastery founded in Bavaria.

604. St. Paul's church founded by Ethelbert, king of Kent.

605. Bells introduced into churches.

611. Westminster Abbey founded by Sibert, king of the East Saxons. Henry the Seventh's chapel built in 1504.

644. Cambridge University, or rather an academic institution, founded by Sigebert, king of East Anglia: the present University appears to have been founded in 915.

660. Organs introduced into churches.

718. The kingdom of the Asturias founded by Pelagio.

744. Monastery of Fulda, in Germany, founded.

762. Bagdad built by Almansor.

829. St. Marks, at Venice, built.

886. Alfred founds the University of Oxford.

895. The monastery of Clune founded.

1035. The kingdoms of Castile and Arragon begin.

1036. Commencement of the kingdom of Norway.

1119. Bohemia formed into a kingdom.

1156. The city of Moscow founded.

A. D.

1179. The University of Padua founded: enlarged, 1221.

1200. The University of Salamanca, founded by Alphonso IX.

1201. City of Riga founded.

1228. The University of Thoulouse founded.

1238. The University of Vienna founded.

1250. The Sorbonne founded in Paris.

1272. The Academy of Florence founded.

1273. Commencement of the Austrian empire.

1281. Marienburgh built by the Teutonic knights.

1282. The Academy of Della Crusca founded.

1290. University of Lisbon founded: removed to Coimbra, 1308.

1298. Foundation of the Ottoman empire.

1302. The University of Avignon founded.

1312. The University of Orleans founded.

1339. The Academy of Pisa established.

1347. The University of Cracow founded.

1348. The University of Prague founded.

1365. The Geneva and Vienna Universities founded.

1411. The University of St. Andrews founded.

1427. The Academy of Louvain founded.

1448. The Vatican founded at Rome.

1450. The University of Glasgow founded.

1470. Plaster casts invented by Verochio.

1479. The University of Upsal founded.

1494. The University of Aberdeen, king's college, founded.

A. D.

1504. King Henry the Seventh built a chapel at Westminster Abbey.

1543. The Academy of Verona founded.

1575. The University of Leyden founded.

1581. The University of Edinburgh founded.

1591. The University of Dublin founded.

1593. Marischal College, Aberdeen, founded.

1635. The French Academy established in Paris.

1643. The Royal Academy of Painting founded by Louis XIV.

1662. The Royal Society established.

1663. The Royal Academy of Inscriptions and Belles Lettres established.

1664. The Academy for Sculpture established in France.

1666. The Fire of London, which destroyed thirteen thousand two hundred houses.

1674. The Academy of Soissons established.

1701. Academy of Sciences founded at Berlin.

1750. Academy of Sciences founded at Stockholm.

1768. The Royal Academy of Arts established in London.

The reader being thus enabled to furnish himself with every information relative to the time when the different states were founded, and, consequently, by reference to the articles, *Egyptian Architecture, Roman Architecture, Grecian Architecture, &c. &c. &c.* of the rise and declension of the art in the different ages and nations of the world, we shall now proceed to detail such particulars as we conceive will be highly beneficial to the student, and even to those more advanced in the art. This information will relate to the *principles of architecture.* For, from the time of Vitruvius till very recently, we have been told of grandeur, order, proportions, harmony, &c.; but it has never been distinctly stated upon what principles these are founded, nor by what means they are to be attained.

This very necessary and important art has, therefore, hitherto been too frequently directed by capricious fancy; and the expense and durability of its works have alone prevented it from experiencing changes equally rapid with those of furniture and dress. This information, according to the opinion of professor Stewart, (with which we accord,) is to be found only in Mr. Alison's *Essay on the Principles of Taste.* We shall therefore endeavour, in the first place, to give Mr. Alison's opinion of the principles of taste, and of the proportion or fitness of the general outline of buildings; and then proceed, with the same author, to treat of the orders of architecture, and to show that their proportions instead of being intrinsically beautiful of themselves, are regulated by those general principles which we are now about to elucidate, and that they derive their merit solely from the expressions of fitness for their several purposes.

In treating of the sublimity and beauty of the material world, Mr. Alison observes, "It cannot be doubted that many objects of the material world are productive of the emotions of sublimity and beauty. Some of the fine arts are altogether employed about material objects; and by far the greater part of the instances of beauty and sublimity which occur in any man's experience, are found in matter, or some of its qualities; on the other hand, it must be allowed, that matter in itself is unfitted to produce any kind of emotion." And again, "But although the qualities of matter are in themselves incapable of producing emotion or the exercise of any affection; yet, it is obvious, that they produce this effect from their associations with other qualities." And, "in works of art, particular forms are signs of dexterity, of convenience, of utility;" and, "in such cases, the constant connections we discover between the sign and thing signified, between the material quality and the quality productive of emotion, renders the one expressive to us of the other, and very often disposes us to attribute to the sign that effect which is produced by the thing signified."

As architecture is much affected by all that relates to form, we would strongly urge young architects to pay attention to what this enlightened philosopher has advanced respecting it. He states, "of all the material qualities, that which is most generally and naturally productive of the emotions of sublimity and beauty, is form; other qualities may be separated from most objects without destroying their nature; but the form of every material object, in a great measure constitutes its nature and essence, and cannot be destroyed without destroying the individual subject to which it belongs. From whatever cause, therefore, the beauty of any material object proceeds, it is natural to ascribe it to the form, or to that quality which most intimately belongs to the object, and constitutes its essence to our senses; the common opinion, therefore, undoubtedly is, that forms, in themselves, are beautiful; that there is an original and essential beauty in some particular forms, and that this quality is as immediately discernable as the forms themselves."

Having premised thus much, he proceeds to state, that the sublimity or beauty of forms arises altogether from the associations we connect with them, or the qualities of which they are expressive to us: and he soon afterwards teaches us, that the sublimity of inanimate forms arises chiefly from two sources; 1st, from the nature of the objects distinguished by that form; and 2ndly, from the quantity or magnitude of the form itself. Thus forms which distinguish bodies that are connected in our minds with ideas of danger, power, strength, splendour or magnificence, awe or solemnity, are in general sublime. Magnitude is sublime as associated with power or strength; with height, it is expressive to us of elevation and magnanimity; with depth, of danger or terror; with length, of vastness, and when apparently unbounded, of infinity; and with breadth, of stability, of duration, of superiority to destruction. That magnitude is only sublime in consequence of these associations is shown by many illustrations; and from the whole he deduces the following conclusions: 1st, that there is no determinate magnitude, which is solely or peculiarly sublime, as would necessarily be the case, were magnitude itself the cause of this emotion; 2ndly, that the same visible magnitude which is sublime in one subject, is often very far from being sublime in another; and 3dly, that magnitude, according to its different appearances, has different characters of sublimity corresponding to the different expressions which such appearances have; whereas, if it were in itself sublime, independently of all expression, it would in all cases have the same degree, and the same character of sublimity.

With respect to the natural beauty of forms, it is stated, that matter is circumscribed by either angular lines, or by curved or winding lines: and that the greatest part of those bodies in nature which possess hardness, durability, and strength, are distinguished by angular forms; while those, on the contrary, which possess weakness, fragility, or delicacy, are distinguished by winding or curvilineal forms. Lines differ in regard to their nature, according to the different degrees of their consistence or strength. *Strong and vigorous lines*, when perpendicular, are expressive to us of strength and stability; and when horizontal, or in an oblique direction, of some degree of harshness or roughness.

Fine and faint lines are expressive to us of fineness, smoothness, and delicacy. In any given number of straight lines, that is always the most beautiful which is finest, or which, while it preserves its continuity, has the appearance of the smallest quantity of matter employed in the formation of it.

Strong and even lines express strength and smoothness. They have therefore a degree of beauty. *Fine and even lines* express delicacy and smoothness. They are accordingly more beautiful than the former.

Strong and angular lines express strength and harshness. They are therefore very seldom beautiful. *Fine and angular lines* express delicacy together with roughness. They are therefore only beautiful when the expression of delicacy prevails over the other.

Strong and winding lines express strength and gentleness, or delicacy. Their effect is therefore mutually destroyed, and they become indifferent, if not unpleasing. *Fine and winding lines* express delicacy and ease; and are accordingly peculiarly beautiful.

The least beautiful lines are strong and angular lines. The most beautiful, fine and winding lines.

In architecture the great constituent parts require direct and angular lines, in order to convey the expression of stability and strength; and no ornament can with propriety be introduced, excepting in the minute and delicate parts of the work; and if those ornaments, even in such situations, exceed in size or relief that proportion in point of delicacy we expect them to hold with respect to the whole of the building, the imitation of the most beautiful forms does not preserve them from censure of clumsiness or deformity.

From a variety of considerations, Mr. Alison then deduces the following conclusions: 1. that wherever natural forms are imitated, those will be the most beautiful which are most expressive of delicacy and ease; 2. that wherever new or arbitrary forms are invented, that form will be the most beautiful which is composed of the most beautiful lines; or, in other words, by lines which have the most pleasing expression; 3. that wherever the subject of the form is of a hard or durable nature, that form will be the most beautiful in which the smallest quantity of matter is employed, and the greatest delicacy of execution exerted; 4. that whenever beautiful form is intended, in complex forms, some character or expressive form should be selected, as the ground or subject of the composition; and 5. that the variety, whether in the form, the number, or the proportion of the parts, should be adapted to the peculiar nature of this expression, or of that emotion which this expression is fitted to excite.

Forms of this kind, are either simple or dependent. In simple or independent forms their character is at the pleasure of the artist; and that will always be the most beautiful, in which the character is best preserved. In dependent forms, on the contrary, or those which are designed for particular scenes or situations, their character must be determined by that of the scene or situation; and that also will be the most beautiful form, in the composition of which the alliance to the general character is most precise and delicate.

Having dicussed what relates to simple and composed forms, or what constitutes their natural beauty, Mr. Alison next proceeds to examine into the qualities which constitute their relative beauty.

From the discovery of fitness or utility, we infer the existence of design. In forms distinguished by such qualities, the discovery of an end suggests intention or design; and the qualities of form, which signify this fitness or usefulness, are signs of the design or thought which produce them. The natural quality most powerfully expressive of design is uniformity or regularity. In every form where this quality is observed, we infer design; and from the absence of it, we consider the production the work of chance.

Vegetable forms which approach to the resemblance of animals, and minerals that have a resemblance to vegetables or animals, are reckoned curious, but are never considered as possessing that beauty which excites the emotion of delight. Uniformity and regularity, therefore, are only beautiful when associated with intention or design.

Uniformity being expressive of design, and variety of embellished design, the beauty of forms will be most perfect when these two are duly proportioned; that is, when the unity of design is equal, the beauty of forms will be in proportion to their embellishment; and when the embellishment is equal, their beauty will be in proportion to the unity of design.

To these we may add, as a fundamental principle, that the expression of design should be subject to the expression of character; and that in every form, the proportion of uniformity and variety which the artist should study, ought to be that which is accommodated to the nature of this character, and not to the expression of his own dexterity and skill.

Mr. Alison considers next, that fitness and proportion constitute relative beauty; and then proceeds to show, that the beauty of the proportion of this art is resolvable into the principles which have been established; and that they please us, not from any original law of our nature, but as expressive of fitness. The proportions of architecture relate either to its external or internal members. The beauty of the external appearance arises from its apparent fitness for the habitation of man; and consists in stability and sufficiency for the support of the roof. Walls, in every country, are, at the same period of time, nearly of an equal thickness. It is therefore easy for the spectator to judge whether they are, or are not, sufficient for these two purposes. When the walls are of such a height as seems sufficient both for their own stability, and for the support of the weight which is imposed upon them; and when the distance between them is such, as appears sufficient for supporting the weight of the roof, we consider the house well or properly proportioned. When any of these circumstances, on the contrary, are different—when the walls are either so high as to seem insecure, the roof so large as to seem too heavy for its support, or the side walls so distant as to beget an opinion of its insecurity, we say, that the building, in such particulars, is ill-proportioned. Proportion, therefore, in those cases, is merely fitness, and this has never been very precisely determined; we are guided entirely by experience, and our sentiments respecting proportions are influenced by the nature of the buildings, and the materials of which they are composed. For example, a house built of brick or wood does not admit of the same height of wall as if built with stone. A house which is united with others, admits of a greater height than if it stood alone, because we conceive it to be supported by the adjoining houses. And a building which has no roof, or nothing that it appears to support, as a tower or spire, admits of a much greater height than any other species of building. These principles are all that seem to regulate the external proportions of simple buildings, and all of them are obviously dependent upon fitness.

Having discussed what relates to the proportion or fitness of the general outline of buildings, Mr. Alison proceeds to treat of the orders of architecture, and to show that their proportions, instead of being intrinsically beautiful of themselves, are regulated by the general principles which have been established in his essay, and derive their merit solely from the expressions of fitness for their several purposes. We shall here quote the precise words of the author:—

"It is not in such (simple) buildings, accordingly, that any accurate external proportions have ever been settled. This is peculiar to what are called the orders of architecture, in which the whole genius of art has been displayed, and in which their proportions are settled with a certainty so absolute, as to forbid almost the attempt at innovation.

"There are generally said to be five orders of architecture, viz. the Tuscan, the Doric, the Ionic, the Corinthian, and the Composite. There are, however, properly only four, and some writers have farther reduced them to three. What constitutes an order, is its proportions, not its ornaments. The Composite having the same proportions as the Corinthian, though very different with respect to its ornaments, is properly, therefore, considered a corrupted Corinthian.

"Every order consists of three great parts, or divisions; the base, the column, and the entablature; and the governing proportions relate to this division. The whole of them compose the wall, or what answers to the wall of a common building, and supports the roof.

"There is one great difference, however, to be observed between a common wall, and that assemblage of parts which constitutes an order. A common wall is intended to support a roof, and derives its proportions, in a great measure, from its destination. To an order, the consideration of a roof is unnecessary; it is generally so contrived as not to appear; the weight which is supported, or appears to be supported, in an order, is the entablature. The fitness of a wall consists in appearing adequate for supporting the roof. The fitness of an order, or of the proportions of an order, it should seem also from analogy, reasonable to conclude, consists in their appearing adequate to the support of the entablature, or the weight which is imposed on them.

"That this is really the case, and that it is their being expressive to us of their fitness, that the proportions of these different orders appear beautiful, may perhaps seem probable from the following observations:—

"1. The appearance of the proportions themselves seems very naturally to lead us to the conclusion. In all the orders, the fitness of the parts to the support of their peculiar weight, or appearance of weight of entablature, is apparent to every person, and constitutes an undoubted part of the pleasure we receive from them. In the Tuscan, where the entablature is heavier than in the rest, the column and base are proportionably stronger. In the Corinthian, where the entablature is lightest, the column and base are proportionably slighter. In the Doric and Ionic, which are between these extremes, the forms of the column and base are in the same manner proportioned to the reciprocal weights of their entablature; being neither so strong as the one, nor so light as the other.

"If the beauty of such proportions is altogether independent of fitness, and derived from the immediate constitution of our nature, it is difficult to account for this coincidence; and as the beauty of fitness, in these several cases, is universally allowed, it is altogether unphilosophical to substitute other causes of the same effect, until the insufficiency of this is clearly pointed out.

"2. The language of mankind upon this subject, seems to confirm the same opinion. Whenever we either speak or think of the proportions of these different orders, the circumstances of weight and support enter both into our consideration and our expression. The term proportion, in its general acceptation, implies them; and if this term is not used, the same idea, and the same pleasure, may be communicated by terms expressive of the support for weight. Heaviness, and slightness, or insufficiency, are the terms most generally used to express a deviation on either side from the proper relation; both of them obviously including the consideration of support, and expressing the want of proportion. When it is said, that a base, or column, or entablature, is disproportioned, it is the same thing as saying, that this part is unfitted to the rest, and inadequate to the proper end of the building. When it is said, on the other hand, that all the several parts are properly adjusted to their end, and that the base appears just sufficient for the support of the column, and both for that of the entablature, every person immediately concludes, that the parts are perfectly proportioned; and I apprehend, it is very possible, to give a man a very perfect conception of the beauty of these proportions, and to make him feel it in the strongest manner, without ever mentioning to him the name of proportion, merely by explaining them to him under the consideration of fitness, and by showing him from example, that these forms are the most proper which can be devised for the end to which they are destined. If our perception of the beauty of proportion, in such cases, were altogether independent of any such considerations, I think that these circumstances in language could not possibly take place, and that it would be as possible to explain the nature and beauty of proportions by terms expressive of sound or colour, as by terms expressive of fitness of propriety.

"3. The natural sentiments of mankind on this subject, seem to have a different progress from what they could naturally have, if there were any absolute beauty in such proportions discoverable by the eye. It cannot surely be imagined that an infant will perceive, or does perceive, the beauty of such proportions in the same manner as he perceives the object of any other external sense. It is not found either that the generality of mankind, even when come to mature age, express any sense of the absolute beauty of such objects. It is true, indeed, that very early in life we are sensible of disproportion in building, because the ideas of bulk and support are so early and so necessarily acquired; and the eye is so soon habituated to judge of weight from visible figure, that what is fit for the support of weight, is very soon generally ascertained. What a common person, therefore, expresses upon the view of such proportions, is rather satisfaction than delight. It is not the proportions that most affect him; it is the magnificence, the grandeur, and costliness, which such buildings usually display; and though he is much pleased with such expressions, he is generally silent with regard to the beauty of those proportions with which the connoisseurs are so much enraptured. If the proportions, on the contrary, were something absolutely beautiful, in such objects the progress of taste would be reversed; the admiration of the infant would be given to those proportions, long before he was able to judge of their fitness; and the satisfaction which arises from the pleasure of fitting would be the last ingredient in his pleasure, instead of being, as it now is, the first.

"4. The nature of these proportions themselves seem very strongly to indicate their dependence upon the expression of fitness. The beauty of such forms (on the supposition of their absolute and independent beauty) must either consist in their beauty, considered as individual objects, or in their relation to each other. If the effect arises from the nature of the individual forms, then it must obviously follow, that such forms or proportions must be beautiful in all cases. I think, however, there is no reason to believe this to be the case; the base of a column, for instance, (taken by itself, and independent of its ornaments, which, in this inquiry are entirely excluded from consideration,) is not a more beautiful form than many others which are given to the same quality of matter. The peculiar form which its proportions give to it, is very far from being beautiful in every other case, as it would necessarily happen, if it were beautiful in itself, and independent of every other expression. A plain stone of the same magnitude, may surely be carved into very different forms from those which constitute the bases of many of the orders, and may still be beautiful. In the same manner, the column (considered as in the former case, merely in relation to its peculiar form, and independent of its ornaments,) is not more beautiful as a form, and perhaps not so beautiful as many other forms of a similar kind. The trunk of many trees, the mast of a ship, the long slender Gothic column, and any other similar objects, are to the full as beautiful, when considered merely as forms, without any relation to end, as any of the columns in Greek architecture. If, on the contrary, these forms are beautiful in themselves, and as individual objects, no other similar forms could be equally beautiful, but such as had the same proportions. The same observations will apply equally to the form of the entablature. It would appear, therefore, that it is not from any absolute beauty of these forms, considered individually, that our opinion of their beauty in composition arises. If it is said, on the other hand, that the beauty of proportion in such cases arises in relation of such parts, and that there is something in the relations of these forms and magnitude, in itself beautiful, independent of any consideration of fitness, there seem to be equal difficulties. Besides the relation of fitness for the support of the weights, the only relations which take place among these parts, are the relations of length and breadth, and the relation of magnitude. If this beauty arises from the relation of length, it is necessary to show, that such a proportion of these parts, in point of length, is solely and permanently beautiful. If from both together, then the same proportion only ought to be felt as beautiful, in all cases to which the relations of length and breadth can apply. If again this beauty arise from the relation of magnitude, it is necessary in the same manner to show that their magnitudes or quantities of matter, have in fact no other beautiful proportions, but those which take place in such order; but as it is very obvious that there is no foundation for supposing there is any such law in our nature, and that on the contrary in innumerable cases of all such relations, different and contrary proportions are beautiful; it cannot be supposed that such proportions are absolutely beautiful from any of these relations. The only relation, therefore, that remains, is the relation of fitness, and if the same inquiry is carried on, I believe it will soon be found that a certain proportion of parts is necessarily demanded by this relation, and very probably also, that this certain proportion is, in fact, in each of these orders, according to the particular weight or bulk given.

"If an order is considered as an assemblage of weight, and parts to support that weight, our experience immediately leads us to conceive a proper relation of those parts to their end. If the entablature be considered as the weight, then of course a certain form and size in the column is demanded for the support of it, and in the base for the support of both. A plain stone for instance, set on its end, has no proportion further than for the purpose of stability. If it appears firm it has all the proportions we desire or demand; and its form may be varied in a thousand ways, without interfering with our sense of its proportions. Place a column, or any other weight, on this stone, immediately another proportion is demanded, viz. its proportion to the support of this weight. The form supported has, however, no proportion further than is necessary for its stability. It may be more or less beautiful in point of form from other considerations, but not on account of its proportion. Above this again place an additional body, immediately the intermediate form demands a new proportion, viz. to the weight it supports; and the first, or base, demands also another proportion, in consideration of the additional weight which is thus imposed upon it. In this supposition, it is obvious, that the consideration of fitness alone leads us to expect a certain proportion among each of these parts. The parts are beautiful or pleasing, just as they answer to this demand; and where the parts are few, and experiments easy, it seems not difficult at last to arrive at that perfect proportion which satisfies the eye, as sufficient for the purpose of support or stability. If we leave, therefore, every thing else out of consideration, the consideration of fitness alone seems to account both for the origin of such proportions in architecture, and for the pleasure which attends the observation of them.

"But granting that the doctrine of original beauty of proportion be abandoned as inconsistent with experience, and that of the influence of the expression of fitness be adopted, yet it may still be doubted if this is sufficient to account for the delight felt from the orders of architecture, or the uniform adherence to the established proportions.

"It is acknowledged that the mere consideration of fitness is insufficient to account for the pleasure derived from the established orders. But it is observed, that this pleasure arises from their proportions; and that, in fact, when these proportions only are considered, the pleasure that is generally felt is not greater than that which we experience, when we perceive in any great work the proper relation of means to an end.

"The proportions of these orders it is to be remembered, are distinct subjects of beauty, from the ornaments with which they are embellished, from the magnificence with which they are executed, from the purposes of elegance they are intended to serve, or the scenes of grandeur they are destined to adorn. It is in such scenes however, and with such additions, that we are accustomed to observe them; and while we feel the effect of these accidental associations we are seldom willing to examine what are the causes of the complex emotion we feel, and readily attribute to the nature of architecture itself the whole pleasure which we enjoy. But besides these, there are other associations we have with these forms, that still more powerfully serve to command our admiration, for they are the Grecian orders; they derive their origin from those times, and were the ornament of those countries which are most hallowed in our imaginations; and it is difficult for us to see them, even in our modern copies without feeling them to operate upon our minds as relics of those polished nations where they first arose, and of that greater people by whom they were borrowed. While this species of architecture is attended with so many and so pleasing associations, it is difficult for even a man of reflection to distinguish between the different sources of this emotion; or in the moments when this delight is felt, to ascertain what is the exact proportion of his pleasure which is to be attributed to these proportions alone; and two different causes combine to lead us to attribute to the style of architecture itself, the beauty which arises from many other associations."

Independently of what Mr. Alison has here advanced, it may not be altogether useless to detail to the reader the opinion he has given of the different orders, in the earlier part of his work. "The orders of architecture," he states, "have different characters from several causes, and chiefly from the different quantity of matter in their entablatures. The Tuscan is distinguished by its severity; the Doric by its simplicity; the Ionic by its elegance; the Corinthian and Composite by their lightness and gaiety. To these characters, their several ornaments are suited with consummate taste. Change these ornaments, give to the Tuscan the Corinthian capital, or to the Corinthian the Tuscan, and every person would feel not only a disappointment from this unexpected composition, but a sentiment also of impropriety from the appropriation of a grave or sober ornament to a subject of splendour, and of a rich or gaudy ornament to a subject of severity."

The preceding observations relate wholly to the external parts of architecture; but as the internal proportions are guided by the same principles, we shall merely state, that the observations offered by Mr. Alison on the beauty of the internal proportions of architecture, afford sufficient evidence for concluding, in general, that the beauty of these proportions is not original and independent, but that it arises, in all cases, from the expression of some species of fitness. The fitness which such proportions may express, is of different kinds:

"1. One beauty of these proportions, arises from their expression of fitness for the support of the weight imposed.

"2. A second source of their beauty, consists in their expression of fitness for the preservation of the character of the apartment.

"3. A third source of their beauty, consists in their expression of fitness, in the general form, for its peculiar purpose or end.

"The two first constitute the permanent beauty, and the third the accidental beauty of an apartment.

"The most perfect beauty that the proportions of an apartment can exhibit, will be when all these expressions unite; or when the same relations of dimensions which are productive of the expressions of sufficiency, agree also in the preservation of character, and in the indication of use."

From the whole of the foregoing discussions and illustrations, Mr. Alison has drawn the following conclusions:—

"That the principal sources of the beauty of forms are: 1st, the expression which we connect with peculiar forms, either from the form itself, or the nature of the subject formed; 2dly, the qualities of design, and fitness, and utility, which they indicate; and 3dly, the accidental associations which we happen to connect with them.

"All forms are either ornamental or useful.

"The beauty of merely ornamental forms appears to arise from three sources:

"1. The expression of the form itself.

"2. The expression of design.

"3. Accidental expression.

"The real and positive beauty, therefore, of every ornamental form, will be in proportion to the nature and the permanence of the expression by which it is distinguished. The strongest and most permanent emotion, however, we can receive from such expressions, is that which arises from the nature of the form itself. The emotion we receive from the expression of design, is neither so strong nor so permanent; and that which accidental associations produce, perishes often with the year which gave it birth. The beauty of accidental expression is as variable as the caprice or fancy of mankind. The beauty of expression of design varies with every period of the art. The beauty which arises from the form itself is alone permanent, as founded on the uniform constitution of the human mind. Considering, therefore, the beauty of forms, as constituted by the degree and permanence of their expression, the following conclusions seem immediately to suggest themselves.

"1. That the greatest beauty which ornamental forms can receive, will be that which arises from the expression of the form itself.

"2. That the next, will be that which arises from the expression of design or skill. And

"3. That the least will be that which arises from accidental or temporary expression.

"In all those arts, therefore, that respect the beauty of form, it ought to be the unceasing study of the artist to disengage his mind from the accidental associations of his age, as well as the common prejudices of his art; to labour to distinguish his productions by that pure and permanent expression, which may be felt in every age, and to disdain to borrow a transitory fame, by yielding to the temporary caprices of his time, or by exhibiting only the display of his own dexterity and skill."

The reader who has attentively perused this slight sketch of Mr. Alison's valuable investigations, will, we doubt not, agree with us, that he has distinctly established the true principles of architecture; and we trust that the liberal-minded artist will perceive, that the direct path to eminence in his profession is precisely marked out, and that he has no longer cause to dread being entangled in uncertainty and confusion.

Architrave. This word is derived from the Greek "*ἀρχὸς*" *chief*, and the Latin, "*trabs*," *a beam*: and signifies that part of the entablature which rests immediately upon the columns. See Pl. M^3, *Mouldings*.

In vestiges of ancient Grecian temples at Athens and Corinth, as also at Pæstum in Sicily, the architrave of the doric order is of very great height, being nearly equal to the diameter of the column, and has but one facia; but in the doric order of the theatre of Marcellus, at Rome, where it has also but one facia, the architrave is much lower, being only equal to half of the diameter of the column. The moderns, in restoring ancient architecture, have generally followed the last of these proportions; but have given to the architrave two facias; taking the idea from some ancient examples of the doric order still existing in Italy.

In the ionic order, the Grecians varied the number of their facias from one to three, sometimes making them quite plain, and at other times enriching the upper mouldings. The moderns, however, confine this order to two facias.

In the corinthian and composite, the ancients gave to the first three, and to the last two facias; but the moderns give three facias to each of these orders.

In gothic architecture there is no architrave, and the arches spring immediately from the tops of the columns. This forms the most striking characteristic difference between the architecture of the ancients and that of the middle ages.

Architrave of a door. A collection of members surrounding the aperture of a section similarly to the architraves of the ionic and corinthian orders, &c. The upper part or lintel is called the *traverse*; and the sides, the *jambs*. For further information, see *Door*.

Architrave cornice. An entablature consisting of an architrave and cornice without the intervention of the frieze. Architrave cornices are introduced when it is inconvenient to give the entablature its usual height. An example of this kind among the ancients may be seen in the Caryatic portico, at Athens. Vide Pl. *Pandroseion*.

Archivault. Vide *Archivolt*.

Archives. A repository or closet for the preservation of writings or records. A secret closet.

Archivolt. This word is derived from the French "*archivolte*," and is the same as the Latin "*arcus volutus*." The archivolt is a collection of members forming the inner contour of an arch, or a band or frame adorned with mouldings, running over the faces of the arch-stones and bearing upon the imposts.

The archivolt differs in the different orders. In the tuscan it has only a single face; it has two faces crowned in the doric and ionic; and in the corinthian and composite it has the same mouldings with the architrave.

Archivoltum. *In mediæval architecture.* An arched receptacle for filth. A cesspool or common sewer.

Archivum. Arceps. Archarium. *In mediæval architecture.* Archives.

Archoid. If the ends of a prism be a conic section, contained by a portion of the curve next to a vertex, and double ordinate to the axis, and not exceeding the half of the entire figure; when the curve is an ellipse, the prism is called an *archoid*. This geometrical solid is denominated a circular, an elliptic, hyperbolic, or parabolic archoid, as its ends are portions of these curves. The circular, or elliptic, archoid, is also denominated a cylindric, or cylindroidic archoid. When applied to building, the space it occupies is called an arch vault, or a vault, the line of its surface forming the intrados of the vault.

The part of an inverted arch opposite to the ceiling of the vault, or arch, is sometimes called the *floor of the arch*.

Archwise. *adj.* In the form or shape of an arch.

Arcs doubleaux. The soffits of arches.

Arcuature. The bending or curvature of an arch. The intrados.

Arcus. The avenue, or area,

which was usually formed in front of the ancient Basilicæ.

Arcus ecclesiæ. *In mediæval architecture.* The arch by which the nave of the church was divided from the choir or chancel. This arch, among ecclesiastical authors of the middle ages, is often called *arcus triumphalis.* As the triumphal arches in heathen Rome were adorned with military trophies, and the deeds of the emperors to whose honour they were raised; so the arcus ecclesiæ and also the arcus presbyterii were decorated with ornaments allusive to the christian faith. The holy sign of the cross, the sufferings of the martyrs, emblems of the triumph of religion over the grave, were among the subjects displayed in mosaic in these situations.

Arcus presbyterii. *In mediæval architecture.* The arch over the tribune marking the boundaries of the recess which composed it. Its decorations were similar to those of the *arcus ecclesiæ.*

Arcus toralis. The lattice separating the choir from the nave in the Basilicæ.

Area. *In architecture.* A small court or place sunk below the general surface of the ground, before and level with the floor of the basement story of a building.

Area. *In geometry.* The superficial content of any figure. For example: Pl. M¹, "*Mensuration of Superficies.*"

Prob. 1. To find the area of a parallelogram: whether it be a square, a rectangle, a rhombus, or a rhomboid.

Multiply the length by the breadth, or perpendicular height, and the product will be the area.

Ex. 1. To find the area of a square, whose side is 6 inches, or 6 feet, &c.

$$\begin{array}{r} 6 \\ \underline{6} \\ \text{Answer } 36 \end{array}$$

2. To find the area of a rectangle, whose length is 9, and breadth 4 inches, or feet, &c.

$$\begin{array}{r} 9 \\ \underline{4} \\ \text{Answer } 36 \end{array}$$

3. To find the area of a rhombus, whose length is 6 chains, and perpendicular height 5.

$$\begin{array}{r} 6 \\ \underline{5} \\ \text{Answer } 30 \end{array}$$

Prob. 2. To find the area of a triangle.

Rule 1. Multiply the base by the perpendicular height, and half the product will be the area.

Rule 2. When the three sides only are given: add the three sides together, and take half the sum; from the half sum substract each side separately; multiply the half sum and the three remainders continually together; and the square root of the last product will be the area of the triangle.

Ex. Required the area of the triangle whose base is 6 feet, and perpendicular height 5 feet.

6
5
2)30(15 answer.

Prob. 3. To find one side of a right-angled triangle, having the other two sides given.

The square of the hypothenuse is equal to both the squares of the two legs. Therefore,

1. To find the hypothenuse; add the squares of two legs together, and extract the square root of the sum.

2. To find one leg; subtract the square of the other leg from the square of the hypothenuse, and extract the root of the difference.

Ex. 1. Required the hypothenuse of a right-angled triangle, whose base AB is 40, and perpendicular BC 30.

4 3
4 3
16 9
9
25(5 the square root of the sum of the
25 two squares, being the hypothenuse AC.

2. What is the perpendicular of a right-angled triangle, whose base AB is 56, and hypothenuse, AC 65?

56 65
56 65
336 325
280 390
3136 4225
3136
1089(33 the perpendicular which is the root of
9 the remainder of the square of the
hypothenuse AC, when the square of
63 | 189 AB has been subtracted.
3 | 189

Prob. 4. To find the area of a trapezoid.

Multiply the sum of the two parallel sides by the perpendicular distance between them, and half the product will be the area.

Ex. In a trapezoid, the parallel sides are AB 7, and CD 12, and the perpendicular distance AP or CN is 9: required the area.

7
12
19
9
171
85½ area.

Prob. 5. To find the area of a trapezium.

Case for any trapezium.—Divide it into two triangles by a diagonal; then find the areas of these triangles, and add them together.

Note. If two perpendiculars be let fall on the diagonal, from the other two opposite angles, the sum of these perpendiculars being multiplied by the diagonal, half the product will be the area of the trapezium

Ex. To find the area of the trapezium ABCD, the diagonal AC being 42, the perpendicular BF 18, and the perpendicular DE 16.

18
16
34
42
68
136
2)1428
714 answer.

Prob 6. To find the area of an irregular polygon.

Draw diagonals dividing the figure into trapeziums and triangles.. Then find the areas of all these separately, and their sum will be the content of the whole irregular figure.

Ex. To find the content of the irregular figure ABCDEF, in which are given the following diagonals and perpendiculars: namely,

c.a = 10
d.f = 6
c.i = 4
k.e = 2
m.f = 3
n.b = 4

For trapez. d. c. f. e.
ci. 4
ke. 2
6
df. 6
2)36
18 content.

For trapez. c. f. a. b.
n.b. 4
m.f. 3
7
c.a. 10
2)70
35 content.

18 content d. c. f. e.
35 content c. f. a. b.
53 content of the irregular polygon.

Prob. 7. To find the area of a regular polygon.

Rule Multiply the perimeter of the figure, or sum of its sides, by the perpendicular falling from its centre upon one of its sides, and half the product will be the area.

Prob. 8. In a circular arc, having any two of the following lines viz. the chord AB, the versed sine DP, the chord of half the arc AD and the diameter, or the radius AC or CD given, to find the others.

If any two of these lines be given, two sides of one of the right-angled triangles, APC or APD, will be known, and from them the remaining side, and other lines in the arc, may be found by Prob. 3.

Suppose AB and PD be given, then, by Prob. 3, the half of AB, or

AP is a mean proportional between DP and PC + CD; for PC + CD + PD is the diameter of the circle, half of which is the radius, or CA, and by Prob. 3, $AC^2 - AP^2 = CP^2$, and $AP^2 + PD^2 = AD^2$.

Suppose CD and AB be given, then half of AB = AP, and CD = AC; therefore $\sqrt{CD^2 - AP^2} = CP$, and CD − CP = PD $\sqrt{PD^2 + AP^2} = AD$.

Prob. 9. To find the diameter and circumference of a circle, the one from the other.

Rule 1. As 7 is to 22, so is the diameter to the circumference.
As 22 is to 7, so is the circumference to the diameter.
Rule 2. As 113 is to 355, so is the diameter to the circumference.
As 355 is to 113, so is the circumference to the diameter.
Rule 3. As 1 is to 3·1416, so is the diameter to the circumference.
As 3·1416 is to 1, so is the circumference to the diameter.

Ex. 1. To find the circumference of a circle, whose diameter A B is 10.

By Rule 1.

$7 : 22 :: 10 : 31{\cdot}42857$
10
7)220
$31\frac{4}{7}$
or 31·42857 answer.

By Rule 2.

$113 : 355 :: 10 : 31\frac{47}{113}$
10
113)3550(31·41593 answer.
160
470
180
670
1050
330

By Rule 3.

$1 : 3{\cdot}1416 :: 10 : 31{\cdot}416$
the circumference nearly, the true circumference being
31·4159265358979, &c

So that Rule 2, is nearest the truth.

Ex. 2. To find the diameter when the circumference is 100.

By Rule 1.

$$22 : 7 :: 50 : \frac{7 + 25}{11} = \frac{175}{11} = 15\frac{10}{11} = 15.9090 \text{ answer.}$$

By Rule 2.

$355 : 113 :: 50 : 15\frac{10}{11}$
.50
355)5650
71)1130(15·9155
420
650
110
390
350

By Rule 3.

$3{\cdot}1416 : 1 :: 50 : 15{\cdot}9156$
50
3·1416)50·000(15·9156
. . . . .)18584
2876
49
18
2

Prob. 10. **To find the length of any arc of a circle.**

Rule 1. As 180 is to the number of degrees in the arc,
So is 3·1416 times the radius, to its length.
Or as 3 is to the number of degrees in the arc,
So is ·05236 times the radius, to its length.

Ex. 1. To find the length of an arc ADB (Prob. 8,) of 30 degrees, the radius being 9 feet.

3·1416
9
As 180 : 30 ———
Or 6 : 1 : : 282744 : 4·7124
Or 3 : 30 : : ·05236 × 9 : 4·7124
90
4·7124 answer.

Rule 2. From 8 times the chord of half the arc subtract the chord of the whole arc, and ⅓ of the remainder will be the length of the arc nearly.

Ex. 2. The chord AB (Prob. 8,) of the whole arc being 4·65874, and the chord AD of the half arc 2·34947; required the length of the arc.

2·34947
8
18·79576
4·65874
3)14·13702
4·71234 answer.

Prob. 11. To find the area of a circle, the diameter or circumference being given.

Rule 1. Multiply half the circumference by half the diameter, or take ¼ of the product of the whole circumference and diameter.

Rule 2. Multiply the square of the diameter by ·7854.

Rule 3. Multiply the square of the circumference by ·07958.

Rule 4. As 14 is to 11, so is the square of the diameter to the area.

Rule 5. As 88 is to 7, so is the square of the circumference to the area.

Ex. To find the area of a circle whose diameter is 10, and circumference 314·159265

By Rule 1.	*By Rule* 2.	*By Rule* 3.
31·4159265	·7854	sq. circ. 986·96044
10	100	invert. 85970
4)314·159265	area 78·54	6908723
area 78·539816		888264
		49348
		7896
		78·54231 area.

AREA.

By Rule 4.

14 : 11 : : 100
11 area
14)1100(78.57 answer.
98
20
112
80
70
100
98
2

By Rule 5.

31.4159265 circum
56.2951413 invert.
94247779
3141593
1256637
31416
15708
2827
63
19
2
88 : 7 · : 986·96044
7
8)6908·72308
11)863·59038
78·50821 answer.

Prob. 12. To find the area of the sector of a circle.

Rule 1. Multiply the radius, or half the diameter, by half the arc of the sector, for the area. Or take ¼ of the product of the diameter and arc of the sector.

Note. The arc may be found by problem 10.

Rule 2. As 360 is to the degrees in the arc of the sector, so is the whole area of the circle to the area of the sector.

Ex. What is the area of the sector CAB, the radius being 10, and the chord AB 16.

$100 = AC^2$
$64 = AE^2$
$36\ (6 = CE$
$10 = CD$
$4 = DE$
$16 = DE^2$
$64 = AE^2$
$80\ (8·9442719 = AD.$
8
71·5541752
16
3)55·5541752
2)18·5180584 arc ADB
9·2590297 = half arc
10 = radius
92·590297 answer.

Prob. 13. To find the area of a segment of a circle.

Rule. Find the area of the sector having the same arc with the segment, by the last problem.

Find the area of the triangle, formed by the chord of the segment and the two radii of the sector.

Then the sum of these two will be the answer when the segment is greater than a semicircle: but the difference will be the answer when it is less than a semicircle.

Ex. Required the area of the segment ABCD, its chord AB being 12, and the radius EA or CE 10.

100 AE^2
36 AD^2
64 DE^2
its root 8 DE
from 10 CE
2 CD
4 CD^2
36 AD^2
40 chord AC^2
its root 6·324555 chord AC
8
50·596440
12·
3)38·59644
2)12·86548 arc ACB
6·43274 ½ arc
10 radius
64·3274 area of sect. EACB
48·0000 area of triangle EAB
Answer 16·3274 area of segm. ACBA

6 AD
8 DE
48 area of △ EAB.

Prob. 14. To find the area of a circular zone ADCBA.

Rule 1. Find the areas of the two segments AEB, DEC, and their difference will be the zone ADCB.

Rule 2. To the area of the trapezoid DQP add the area of the small segment ADR; and double the sum of the area of the zone ADCB.

Prob. 15. To find the area of a circular ring, or space included between two concentric circles.

The difference between the two circles will be the ring. Or, multiply the sum of the diameters by their difference, and multiply the product by ·7854 for the answer.

Ex. The diameters of the two concentric circles being AB 10 and DG 6, required the area of the ring contained between their circumferences AEBA, and BFGD.

10
6
Sum 16
Dif. 4
64

·7854
64
3·1416
47·124
50·2656 answer.

Prob. 16. **To measure long irregular figures.**

Take the breadth in several places at equal distances. Add all the breadths together, and divide the sum by the number of them, for the mean breadth; which multiply by the length for the area.

Ex. The breadths of an irregular figure, at five equi-distant places, being AD 81, *m* P 7·4, *nq* 9 2, *or* 10·1, BC 8·6; and the length AB 39; required the area.

```
    8·1
    7·4
    9·2
   10·1
    8·6
 5)43·4
   8·68
     39
  78·12
 260·4
 338·52 answer
```

Arena. The plain space in the middle of the amphitheatre, or other places of public resort amongst the Romans, where the gladiators had their combats. The word is Latin, and signifies sand. The place most probably derived its name from the ground being strewed with sand or sawdust, to prevent the combatants from sliding; as also to hide the blood spilt in the contests from the view of the spectators.

Arena. *In architecture.* The middle or body of a temple; comprehending the whole space between the antæ and extreme wall of the building.

Arenaria. A word used by the ancient writers in a sense analogous to the English "*sand-pit.*" A pit out of which sand is dug.

Arenarii. Gladiators, and slaves of the lowest rank, who combated with beasts in the arena.

Arenatum, is used by Vitruvius for a kind of plaster, mortar composed of sand and lime.

Areopagus. A place near Athens, where the Athenians held their court of justice.

Areostyle. Vide *Aræostyle.*

Arris. This word is very much used by all who are connected with the art of building; and though, in general language, it implies the same thing as *edge*, the workmen use those two words in a very different sense. *Arris* is used by them to denote the intersection, or lines on which two surfaces of a body forming an exterior angle meet; and *edge* is only applied to those two surfaces of a rectangular parallelopipedal body, on which the length and thickness may be measured, as in boards, planks, shutters, &c.

Arris fillet. A slight piece of timber of a triangular section, used in raising slates against the shafts of chimneys, or against a wall that cuts across the roof in an oblique direction. It is also used in forming gutters at the upper ends and sides of skylights that have their plane coinciding with that of the roof. When used in raising the slates at the eaves of a building the arris fillet is called eaves-board, eaves-lath, or eaves-catch.

Arsenal. A public storehouse for arms and warlike ammunition.

Artificers. Persons who work with their hands, and manufacture any commodity in iron, brass, wood, &c.

Artisan. Vide *Artificer*.

Arx. A consecrated place on the Palatine mount where the augurs publicly performed their office: also a public place in Rome, set apart for the operations of the augurs.

Arx. *In ancient military art.* A town, fort, or castle, for the defence of a place. Some writers have supposed that the arx and capitol of Rome were the same thing ; but they were two distinct edifices. The arx, according to Ryckius, was a place on the highest part of the Capitoline mount, stronger and much better fortified than the rest, having towers and pinnated walls, and in which was the temple of Jupiter Capitolinus.

Asarotum. A kind of painted pavement used by the Romans before the invention of mosaic work. The most celebrated was that painted by Sesus, at Pergamus, which exhibited the appearance of crumbs, as though the floor had not been swept after meals.

Asbamæa. A fountain dedicated to Jupiter, near Tyana, in Cappodocia.

Ashlar. Common, or free, stones, as they are brought from the quarry, of different lengths and thicknesses.

Asular. The facing of squared stones on the front of a building. When the stones which compose the ashlar facing are quite smooth, and exhibit none of the marks of the tools by which the stones were cut, it is called *plane ashlar.* When wrought in a regular manner, so that the surface has the appearance of parallel flutes, placed perpendicularly in the building, it is called *tooled ashlar.* When the surfaces of the stones are cut with a broad tool, without care or regularity, it is said to be *random-tooled.* When wrought with a narrow tool, *chiselled* or *boasted :* when cut with very narrow tools it is said to be *pointed :* and when the stones project from the joints, with either smooth or broken surfaces, the ashlar is said to be *rusticated.* Neither pointed, chiselled nor random-tooled ashlar can be admitted in good work. In the country, *herring-bone ashlar,* and *herring-random-tooled ashlar* are some times used.

Ashlaring. The act of setting an ashlar facing.

Ashlering. *In carpentry.* The fixing of short upright quarterings in garrets, about two feet and a half or three feet high, between the rafters and the floor, in order to make more convenient rooms, by cutting off the acute angles at the bottom.

Asiminthos. A kind of large vessel in which the Greeks used [illegible] bathe.

Asphaltum. A kind of bituminous stone, found near the ancient Babylon, and lately in the province of Neufchâtel. When this stone is mixed with some other materials, it forms an excellent cement, which is incorruptible by air, and impenetrable by water. It is supposed to be the mortar so much celebrated among the ancients, and used in cementing the walls of Babylon, and the temple of Jerusalem.

Assemblage. The joining, or uniting, of several things together ; or the things themselves so joined or united. Carpenters and joiners have various kinds and forms of assemblage, as by mortise and tenon, dove-tailing, &c.

Assemblage of the Orders. The placing of the columns upon one another in the several anges, so that their axes be in the same straight line.

Assers. A term used in *ancient carpentry*, signifying the laths which supported the tiles of the roof. The denticulated cornice is supposed to have originated from these; and, as they were not disposed horizontally, but according to the inclination of the roof, Vitruvius forbids the use of dentils in pediments. Assers, among the ancients, also implied the ribs or brackets of an arched ceiling.

Association of Orders. Vide *Assemblage*.

Astragal. This word is derived from the Greek αστραγαλος, which signifies strictly a bone in the foot, to which this moulding has been imagined to bear some resemblance. The astragal is a small moulding, having a semicircular profile; and is used in various parts of building. Some have supposed, and with some justice, that it properly represents a ring, on whatever part of the column it may be placed; and that the idea originated in placing a circle of iron round wooden columns, to prevent them from splitting. The astragal and torus are similar figures. The only distinguishing feature is, that when the one is compared with the other, in the same piece of work, the astragal is considerably smaller than the torus. See Plate M^3. and M^4, *Mouldings*. The astragal is sometimes quite plain; at other times it is enriched with beads and berries, as may be seen in the ornamental astragals which separate the facias of the architrave in the corinthian capital of the Maison Quarrée, at Nismes. Pl. C^1, *Capitals*.

As Vitruvius does not mention any astragal between the shaft and hypotrachelion of the doric and tuscan columns, it is not improbable, that the hypotrachelion might be formed without any mouldings whatever, by making it slightly recede within the shaft; or by fluting it, as in Trajan's column. This is rendered still more probable, by its being conformable to all the early examples of the grecian doric order; such as the doric temples at Corinth, Athens, Sicily, and Pæstum. In those temples, the hypotrachelion is separated from the shaft by one, two, or three annular channels, without any projecting moulding, and the flutes are continued upwards through the hypotrachelion, to meet the under side of the annulets. In the ionic order, the ancients never omitted the astragal: and with the exception of but two instances, the one being the temple of Erechtheus, the other of the Minerva Polias, both at Athens, the hypotrachelion was never introduced by them in the ionic column; and the astragal was placed immediately below the echinus. The same is observable in the few remaining examples of the Roman ionic order. In the corinthian monument of Lysicrates, at Athens, which is one of the oldest specimens of the corinthian order, there is no astragal, but there is an annular groove between the shaft and capital, in which probably was inserted a metal ring, or circular moulding. In all other examples of the corinthian order, as well as those of the composite, the astragal is never omitted between the under row of leaves and the shaft. In Egyptian architecture, we sometimes meet with astragals at the top of the shafts, and sometimes with several between the top and bottom, though frequently there is no moulding between the shaft and capital.

Astronomical column. See *Column.*

Asulæ. Marble chips.

Asymptote. A straight line which continually approaches to a curve without touching it.

Bertinus enumerates divers sorts of asymptotes; some straight, others curved; some concave, others convex, &c.; and farther proposes an instrument for measuring them. Though, strictly speaking, the term asymptotes seems only appropriated to straight lines.

Athenæum. *In antiquity.* A public place, built in the form of an amphitheatre, wherein the professors of the liberal arts held their assemblies, the rhetoricians declaimed, and the poets recited their verses. The three most celebrated athenæa were those at Athens, at Rome, and at Lyons; the second of which, according to Aurelius Victor, was built by the emperor Adrian.

Athenodorus. A famous ancient sculptor, who was born at Rhodes, about four hundred and thirty-two years before Christ. He was one of the three who jointly executed the admirable group of Laocoon: the other two were Agesander and Polidore.

Athenian Architecture. Athens, the capital of Attica, was founded by Cecrops, about 1556 years before Christ, and by him named Cecropia. Before the expiration of two centuries, the name was changed into Athens, in honour of Minerva, called by the Greeks *Αθηνη*, who was considered the protectress of the city.

Athens, once enriched with the finest structures, of which even now there are some vestiges, has long engaged the attention of those who apply themselves to the study of architecture. Indeed, those ruins are highly interesting, and generally have been considered the models and standard of regular and ornamental building. Many representations of them, drawn and engraved by skilful artists, have been published; but of those publications none have risen higher in the public estimation than that by the late Messrs. James Stuart and Nicholas Revett. Availing ourselves, therefore, of the information furnished by those gentlemen, we purpose, in this place, to give a very full account of the antiquities of Athens; in fact, a faithful abstract of most of the valuable information comprised in the work generally known by the name of Stuart's "Athens."

1. The building of which we shall first treat, is a doric portico of four fluted columns; generally supposed to be a temple dedicated to Rome and Augustus. The columns, entablature, and pediment, as also one of the antæ, are all sufficiently entire to give an exact idea of its original form and proportion, which is represented in Plate A[1].

The inscription on the acroterium which is placed over the middle of the pediment, and which probably supported a statue of Lucius Cæsar, may be thus translated:

The people (of Athens honour) Lucius Cæsar, the son of the emperor Augustus Cæsar, the son of the god, (with this statue.)

And that on the architrave, thus:—

The people (of Athens) out of the donations bestowed (on them) by Caius Julius Cæsar the god; and by the emperor Augustus Cæsar, the son of the god; (dedicate this) to Minerva Archegetia, (or the chief conductress.) Euclees the Marathonian being commander of the heavy-armed foot, he *likewise succeeded into the office of overseeing this work for his father Herodes: and he had likewise finished his embassy. (Or, who also received the charge of overseeing this building for his father Herodes, who was absent on an embassy.) In the year that Nicias, the son of Serapion, the Athmonian, was archon.*

Near the easternmost column of this portico, there is a quadrangular base. It formerly supported a statue, which, by the inscription still remaining, appears to have represented Julia Augusta, in the character of Providence. The words are to the following effect:

The senate of the areopagus, and the senate of the six hundred, and the people (of Athens by their decree honour) Julia the divine, the august, the provident, (with this statue,) erected at the expense of Dionysius, the son of Aulus the Marathonian; the said Dionysius the Marathonian, and Quintus Nævius Rufus, the Melisean, being prefects of the market.

There was also an inscription over the jamb of the doorcase, which, though much effaced, appears to have been an edict of the emperor Adrian, regulating the sale of oils, and the duties or customs they were obliged to pay.

From the inscription on the architrave it is evident, that this building was not dedicated to Augustus, but to Minerva; and on further examination there appear strong presumptions that it was not only not dedicated to Augustus, but was not a temple. For the wall in which the door is placed, extended on each side beyond the lateral walls of the portico; whereas the usual plan of porticoes is a rectangular parallelogram, and their lateral walls are continued without interruption, from the antæ of the portico, or the posticus or back-front. Besides this, the diameter of these columns are in a smaller proportion to their height, than the diameters of any that are found in the ancient temples of this order now extant; which circumstance, considering the distinction Vitruvius has made between the proportion of those columns which are employed in temples, and of those which are placed in buildings of inferior dignity, adds a considerable weight to this opinion.

It may likewise be remarked, that there is an appearance of impropriety, in supposing that an edict relating to the sale of oils, was inscribed on the gate of a temple; neither, indeed, did Wheler and Spon, when they conceived this to be a temple, understand that the inscription here mentioned was on a part of the building itself: they supposed that it was removed hither from the Prytaneum, or some other neighbouring ruin; whereas, in truth, it is, as has been before observed, in its original situation. It should seem therefore a more reasonable opinion, and more naturally to be inferred from the subject of this inscription, that the portico here treated of, is the remains of an agora or market; the entrance to which, must be allowed a much more appropriate place than the gate of a temple for exhibiting to the public a law, which regulated so important a branch of commerce.

The inscription likewise on the base, which formerly supported the statue of Julia Augusta, furnishes an argument in favour of this opinion: for why should otherwise the names of two persons be mentioned in it, as prefects of the market, when only one was at the expense of the statue? The donor might indeed justly claim this privilege, wherever it was erected; but the other prefect cannot be supposed by any right to enjoy this honour, unless the building before us had some relation to his office.

It may be proper to observe, that there were two agoras in Athens, one called the old agora, and the other the new; the first seems to have been in the ceramicus within the walls, near the dipylon; and the other, which is probably that under our present consideration, was in a part of the city, called Eretria; they were ornamented with monuments of the most celebrated actions of the Athenians, and with statues of those persons who had deserved well of the republic.

2. On the southern bank of the Ilissus, not far from the fountain Enneacrunos, which at present has recovered its more ancient name, and is called Callirrhoë, stands a litte ionic temple, the mouldings of which differ much from all the examples of that order hitherto published. Their forms are extremely simple, but withal so elegant, and the whole is so well executed, that it may doubtless be reckoned among those works of antiquity, which best deserve our attention.

It should be observed, that most of the ancient structures in Athens, of which there are any remains, were entirely built of an excellent white marble, on which the weather has very little effect; consequently, such parts as have not been impaired by violence, are by no means in that mouldering state of decay, to which the dissolvent quality of the air reduces the ordinary buildings of common stone. From which cause it is, that notwithstanding great part of this temple has long since been thrown down and destroyed, whatever remains of it is still in good preservation. The Athenians, probably several centuries ago, repaired this building; and with some barbarous additions, transformed it into a church, dedicated to the Mother of Christ; and called, from its situation, *e Panagia eis ten Petran*, or St. Mary's on the Rock, which name it still retains, although the repairs which were then bestowed on it, are now also gone to decay, and the church is at present totally deserted. Spon supposes that it was anciently dedicated to Ceres, and appropriated to the celebration of the lesser mysteries. It were to be wished that he had produced the authorities on which his opinion is founded: it had then, perhaps, never been controverted, or at least he would have enabled his readers to determine with more ease, and greater accuracy, how far they could concur with him in his sentiments on the subject.

The spot on which it is built commands a very beantiful and extensive prospect; and in the neighbourhood are still visible the ruins and foundations of many edifices, which formerly improved this pleasing situation, and adorned the banks of the Ilissus. Among these were the Lyceum, the Stadium, the altar of the Muses, Illisiades, the monument of Nisus, and the temple of Diana Agrotera: all which Pausanias has enumerated. Of this number was likewise the temple of Boreas, mentioned by Herodotus. But it is evident from many circumstances, that none of them can be the temple here described. These circumstances, however, do not affect the conjecture of Monsieur Spon, which so far deserves credit, as it is certain, that the temple dedicated to Ceres Agrotera was near the city, and on the south side of the Ilissus.

It should not however be omitted, that there was a temple, a statue, and a fountain, which were dedicated to an Athenian hero, named Penops; and they were all of them, probably, near this place, since by a passage in Plato, the fountain appears to have been just without the gate of Athens, which was nearest to the Lyceum and the Ilissus. So small a temple as this of which we have treated, seems not to correspond with the high veneration in which the goddess Ceres was held at Athens; and it could by no means be sufficient for the reception of that train and pomp, which doubtless accompanied the celebration of even the lesser mysteries. It may, therefore, rather be imagined, that the hero Penops was honoured in this temple.

The elevation of the portico is shown in Pl. A¹. In the original building, the cymatium is destroyed, and the two centre columns are wanting. The frieze likewise, which is here represented plain, has most probably been ornamented with basso-relievos.

Plate A². Fig. 1. represents the capital and base of the columns, together with the entablature. The dotted line AA, denotes the present surface of the frieze; and the figures on it are copied from a fragment found at Athens, which may possibly have belonged to this place, since its heighth and thickness is such as exactly supplies the space designed for this ornament. Fig. 2. A section of one quarter of the columns, to show the number and proportion of the fluting. Fig. 3. The manner of forming the flutings.

Pl. A³. is the plan, profile, and section of an angular capital belonging to this ionic temple.

Fig. 1. The plan of the capital, in which it is observable, that the ornament called echinus, (or eggs and anchors) is, contrary to the present custom, continued under the volutes, and quite round the capital.

Fig. 2. The profile of the capital.

Fig. 3. A section through the front of the capital.

Fig. 4. A section through the side of the capital.

Fig. 5. The form and dimensions of the volutes.

3. The octagon tower of Andronicus Cyrrhestes is of marble, on each side is a figure in relievo, representing one of the eight winds; which proves it to be the marble octagon tower, built at Athens by Andronicus Cyrrhestes. This will appear evident from the following description of it given by Vitruvius. "Some have chosen," says he, "to reckon only four winds; the east blowing from the equinoctial sun-rise; the south from the noon-day sun; the west from the equinoctial sun-setting; and the north from the polar stars. But those who are more exact, have reckoned eight winds, particularly Andronicus Cyrrhestes, who on this system erected an octagon marble tower, at Athens, and on every side of the octagon he wrought a figure in relievo, representing the wind that blows against that side. The top of this tower he finished with a conical marble, on which he placed a brazen triton, holding a wand in his right hand. This triton is so contrived that he turns round with the wind, and always stops when he directly faces it, pointing with his wand over the figure of the wind at that time blowing."

In order to give an exact idea

of the present state of this building, it is necessary to observe, that since the time it was erected, the surface of the ground is raised 15 or 16 feet on every side with the exception of that which looks to the north-east, where its utmost height does not exceed 12 feet, for the entrance is on this side, and a considerable quantity of earth has been removed to make it accessible. There were originally two doors to this building. That situate on the north-east side has been already mentioned as still in use; the other, which is on the north-west side, is totally closed up and concealed by the quantity of soil and rubbish, which has so considerably raised the surface of the ground here, and in the neighbourhood. So great an accumulation of earth has diminished the apparent height of the building, and, by consequence, has absolutely destroyed whatever beauty might originally result from its general proportions. The building is moreover much encumbered, and shut up from view, by the ordinary houses near it, as also by the walls of the little enclosures which belong to them. Besides these, all the mouldings within have been so defaced, that it is scarcely possible to determine what was their original form.

It is from these disadvantageous circumstances, that this building does not, at its first appearance, present the spectator with an idea of any extraordinary beauty, or immediately give him that pleasure, which he will receive on a more particular examination of it.

The roof, which is curious for its construction, is of a form remarkably elegant, and wherever it can be seen, has a very fine effect.

The figures on the sides of the octagon are noble pieces of sculpture, both for design and execution, and ingeniously express the characters of the winds they are intended to represent. Under each of these figures there is a sun-dial; and as the east dial is only the west dial reversed, and as the noon-day line in the south dial is a perpendicular, from which the hour lines belonging to the forenoon are equally distant with the corresponding hour lines belonging to the afternoon, it is obvious, that the astronomer who marked out these dials, supposed the sides of this octagon tower exactly fronted the four cardinal, and the four principal intermediate, points of the horizon. Nor was he mistaken. For on applying a magnetic needle, made for such purposes, under the direction of the ingenious and accurate Dr. Knight, to its western side (which, according to this supposition, should be in the plane of the meridian,) it deflected from this side towards the west about 12° 55′; which, as far as could be ascertained by repeated meridian observations of the sun, was at that time the magnetic variation at Athens.

To trace the original form of this building, it was necessary to make several considerable excavations. The first was a trench along the south-east side, where, at the depth of about 14 feet, the upper step appeared; after that two others, and at length the pavement. The trench was then carried round the angle at the southern extremity, with the intention of continuing it on the south side; but here the workmen were obstructed in their operations by a wall, which projected from, and appeared to be, a part of the original structure.

For there is not only a continuation of the same ranges of masonry, but many of the blocks of marble are so wrought, as to be placed partly in the face of the octagon, and partly in this new discovered wall. On further search, the wall appeared to be built on a plan which comprises three-fourths of a circle, and to project from the south side of the octagon, after the manner of a modern bow-window.

On examining the north side of the building, beneath the figure of Skiron, some traces of the other door were discovered; and on the removal of a great quantity of earth, the door-case, and the greater part of two fluted columns, which had formerly supported the entablature, were found in their original situations. Many fragments of the architrave and pediment were also dug up during these researches. From the whole of which, the building has been restored to the form represented in plate A4.

This tower, at the time that Stuart and Revett visited Athens, was appropriated to the purposes of a Turkish chapel; and as a considerable quantity of dirt, to the height of about 7 feet from the pavement, had accumulated in the interior, to the obstruction of their religious dances, the whole had been covered with deal flooring. Stuart and Revett applied to, and obtained permission of, the sheik, or chief of the dervises, to break up this floor and carry away the rubbish; and having removed about 2,700 cubic feet of dirt and stones, came to the pavement, which was found entire. It consists of white marble; and is inwrought with certain cavities and channels, for which no reason can be assigned, unless, indeed, they are, what seems most probable, the remains of a clepsydra or water-dial.

This conjecture appears to be placed almost beyond a doubt by many concurring circumstances. First, from a stream of water, which rises at the foot of the rock on which the Areopolis is built, passing within 10 feet of this place. Secondly, from the discovery of that part of the building already described, as projecting from the south side of the octagon, which might have served as a reservoir, whence the requisite quantity of water was supplied to work the clepsydra. Thirdly, from the principal cavity or channel in the pavement being continued in a straight line from the south side of the octagon to the centre, where there is a circular hole, communicating with a subterraneous passage, which would conveniently serve to carry off the waste water: and, fourthly, that either this stream, or the fountain whence it issues, was anciently called clepsydra.

Independently of the above, it may be observed, that this building, so highly decorated, and situate near to the agora or market, constructed apparently for the express purpose of exhibiting the direction of the wind, the season of the year, the hour of the day, and of regulating the businesses dependent on them, would ill have answered the purposes for which it had been designed, without some such contrivance as a clepsydra.

Plate A4, the elevation of the tower of the Winds: every part of which, with the exception of the conical marble at the top of the building, and the triton that is supported by it, were fairly made out from remains found on the spot. The triton and conical marble are supplied from the description of Vitruvius. It may, perhaps, be necessary to state that, though the capitals given to the columns were found among the ruins, it is probable that they never did belong to them. This kind of capital has been in frequent use at Athens, and in other parts of Greece. That supporting the triton is evidently of the same species; that is, the upper range of leaves is not divided like the acanthus, or any other of the foliages proper to the corinthian capital; but smooth, resembling what our workmen call water-leaves.

4. The choragic monument of Lysicrates, of which we are about to speak, is commonly called by the modern Athenians, "*to phanari tou Demosthenios,*" or the lantern of Demosthenes; and there is a vulgar story still current at Athens, that it was built by that philosopher as a place of retirement and study; but, like many other popular traditions, it is too absurd to deserve a serious refutation.

This monument of antiquity, which is exquisitely wrought, stands near the eastern end of the Acropolis, and is partly enclosed in the hospitium of the Capuchins. It is composed of three distinct parts. First, a quadrangular basement. Secondly, a circular colonnade, of which the intercolumniations were entirely closed: and, thirdly, a *tholus* or cupola with the ornament that is on it.

There is no kind of entrance or aperture in the quadrangular basement, which is entirely closed on every side. On breaking through one of the sides, Stuart and Revett found that it is not quite solid; but the vacant space is so small, and so irregular, that a man can hardly stand upright in it.

The basement supports the circular colonnade, and was constructed in the following manner. Six equal panels of white marble, placed contiguous to each other, on a circular plan, formed a continued cylindrical wall, which was divided from top to bottom into six equal parts by the junction of the panels. On the whole length of each juncture was cut a semicircular groove, into which a corinthian column was fitted with great exactness, so as effectually to conceal the junctures of the panels. These columns projected somewhat more than half their diameters from the surface of the cylindrical wall, and the wall entirely closed up the intercolumniation. Over this were placed the entablature and the cupola, in neither of which was any aperture, so that there was no admission of light to the interior; indeed, it is only 5 feet 11½ inches in the clear, and was therefore never intended for a habitation, or even for a repository of any kind.

An entrance has been since forced into it, by breaking in one of the panels, probably in the expectation of finding treasure. For many of the inhabitants of those countries are reduced to such a state of barbarism, as to imagine, that every work, which is great or beautiful beyond their conception, must be the work of magic, and the repository of hidden treasures. Three of the marble panels being now destroyed, their places are supplied by a door and two brick walls, and the monument is converted into a closet.

It should be observed, that on each of the three panels still remaining, two tripods with handles to them are wrought in basso-relievo: they are, perhaps, of that species which Homer and Hesiod describe by the name of *τρίποδες ωτῶεντες*, or eared-tripods.

The architrave and frieze of the circular colonnade are formed of one block of marble; and on the architrave is an inscription to the following effect:—

Lysicrates, of Kikyna, the son of Lisitheides, was choragus, (or gave the chorus at his own expense.)

The tribe of Akamantis obtained the victory in the chorus of boys. Theon was the performer on the flute. Lysiades, an Athenian, was the teacher of the chorus. Evaenetus was archon.

From this we may conclude, that, on some solemn festival, which was celebrated with games and plays, Lysicrates, of Kikyna, a demos, or borough town, of the tribe of Akamantis, exhibited, at his own expense, on behalf of the tribe to which he did belong, a musical or theatrical entertainment, in which the boys of Akamantis obtained the victory; also that, in commemoration of the victory, this monument was erected to perpetuate the same to posterity. By the name of the archon, or magistrate, in whose time this took place, it appears that the building was erected about three hundred and thirty years before the christian era, in the time of Demosthenes, Apelles, Lysippus, and Alexander the Great.

Round the frieze is represented the story of Bacchus and the Tyrrhenian pirates. The figure of Bacchus, and of the several fauns and satyrs who attend him on the manifestation of his divinity, as also the chastisement of the pirates, and their terror at being transformed into dolphins, are expressed in this basso-relievo with the greatest spirit and elegance.

The cornice, which is composed of several pieces of marble, bound together by the cupola, which is of one entire piece, is crowned with a sort of Vitruvian scroll instead of a cymatium.

The outside of the cupola is wrought with much delicacy. It imitates a thatch or covering of laurel leaves, edged with a Vitruvian scroll, and enriched with ornaments. The flower on the top of the cupola is a very graceful composition; and from the form of the upper surface, and disposition of four remarkable cavities in it, it is probable that it formerly supported the tripod gained as the prize. Three of the cavities are cut on the three principal projections of the upper surface, their disposition being that of the angles of an equi-lateral triangle, in which the feet of the tripod were probably fixed. In the fourth cavity, which is much the largest, and is in the centre of the upper surface, a baluster was in all likelihood inserted to support the tripod and give it that stability and strength which its situation required.

The tripod seems to have been the peculiar reward bestowed by the people of Athens on that choragus, who exhibited the best musical or theatrical entertainment; and we find that this particular custom obtained for these tripods the name of choragic tripods. It was customary for the victor to dedicate the tripod he had won to some divinity, and to place it either on one of the temples already built, or on the top of some edifice erected and consecrated by him for the purpose. Thus they participated of the sanctity of the place, and were secured from injury or violence. A tripod thus dedicated was always accompanied with an inscription; so that it became a permanent, authentic, and public monument of the victory, and of the person who had obtained it.

There were formerly many temples and edifices of this sort in Athens. One is mentioned by Plutarch, as being built by Nicias within the place consecrated to Bacchus; and Pausanius makes mention of a street, leading from the Prytraneum, which took its name from the number of tripods that were in it.

Stuart and Revett conclude their description of the building under consideration, by adducing many circumstances to prove that it was erected for the above purpose; but as these are somewhat irrelevant to the subject for which this book is expressly dedicated, we shall pass them in silence.

Plate A^b, represents the elevation of this building, restored as far as the remains found on the spot authorize, and no farther. In plate *Athenian Order*, (given in No. 13,) the upper part of this monument is shown on a larger scale: and in plate *Athenian Order*, (given in Part 3,) the external face of the capital is also shown on a larger scale. Among the many peculiarities of this singular edifice, the manner of fluting the columns deserves some attention. The lower extremities of these flutings descend below their usual limits, and are cut into the apophyges, or scape of the column, and the upper extremities terminate in the form of leaves. The annular channel immediately above them, which divides the shaft of the column from the capital, was probably filled with an astragal, or collarino of bronze.

5. A stoa, or temple, commonly supposed to be the remains of the temple of Jupiter Olympius, is one of the most considerable remains of Athenian magnificence. It has, even in its present ruinous condition, so striking an effect, that most travellers have mistaken it for the temple of Jupiter Olympius, which, in splendour and majesty, surpassed every other structure in Athens.

What the ancient name of this building was, appears extremely difficult to ascertain; nor will the traditions of the present Athenians assist us in the disquisition, for they call it indifferently, the palace of Pericles, or of Themistocles. It is, however, extremely improbable that any citizen, among those jealous republicans, would venture to erect so splendid a house for his own private habitation. No sculptures or inscriptions were found to throw light upon the inquiry; but the general plan of the external walls may be traced. This, with some other circumstances, render it probable that these ruins are the remains of a stoa or portico, and not of a palace or temple.

The external walls enclose a large quadrangular space, 376 feet 1 inch in length, and 252 feet in breadth. The front looks nearly west-north-west, or, to be more exact, 28° 20′ east of north, and west of south. In the middle are the remains of a gate or entrance, which had formerly an ascension to it of six steps. The whole extent of the front is ornamented with corinthian columns, and is terminated at each extremity by a pteroma, or projecting wall, faced with a corinthian pilaster.

The columns were originally eighteen in number, and were thus disposed: four, being fluted, were placed on the uppermost step in the middle of the front, to support an entablature and pediment, which formed the portal or portico of the gate; and on each side of this portico was a range of seven columns, without flutes. the top of whose pedestals were exactly level with the uppermost step of the portal.

The north-easterly half of the front, with its columns, pedestals, and entablature, is not much defaced; but the south-western column of the portico, together with the entablature which it supported, are wanting. Besides these, there are no remains of the cornice which was over the tympanum of the pediment. The south-westerly half of the front is much ruined; but great part of the wall, together with seven pedestals, and some fragments of the columns that were placed on them, still remain in their original situations. The antæ or pilasters of the portals are entire, as also are those pteroma or wings which limit the extremity, and determine the utmost length, of this front.

The two lateral walls were probably similar to each other: and that on the north-east side of the quadrangle is in a tolerable state of preservation. The outside of this wall has three remarkable projections. The one in the middle, which is rectangular, has probably been an entrance; and those, which are situate one on each side of it, of a semi-circular form, appear to have been what Vitruvius calls exhedræ. They form recesses in the inside of the quadrangle, like those on each side of Westminster-bridge, and doubtless were designed to accommodate such persons as were disposed to sit and converse without interruption.

The back-front part of the building likewise remains in a fair state of preservation; and is supported on the outside by six large plain parastata, or buttresses. There are some traces of a peristyle or continued colonnade which encompassed, on the inside of the walls, the quadrangular space before mentioned. This peristyle was composed of a double range of columns, agreeing in this particular with Vitruvius's description of porticoes. Notwithstanding that a great number of columns were necessary to form such a peristyle, only one remains in its original place, which appears to have been of that range which was farthest from the wall.

About 250 feet distant from the front wall, and exactly facing the gate or entrance, are some old foundations, on which a church, the work of a most barbarous age, has been erected. It is called "*ee Megále Panagia,*" or Great St. Mary's. In these walls are still to be seen an ancient arch, with some other remains of excellent masonry; and contiguous to the church are three columns supporting an architrave, which probably belonged to the same edifice as the arch.

Whatever difficulties may attend the disquisition concerning this building, it is most evident, that it was not, as some have supposed, the temple of Jupiter Olympius. That temple was situate in the southern part of the city, near the fountain Calirrhoe; whereas this building stands to the north of the Areopolis. Those stately ruins, vulgarly called the columns of Adrian, and by some supposed to be the remains of that emperor's palace, stand exactly on the spot assigned by the ancients for the temple of Jupiter Olympius. This, conjoined to many other circumstances which Stuart and Revett have pointed out, prove that those ruins are not the columns of Adrian, but of the temple of Jupiter Olympius.

Wheler and Spon, deluded by the common opinion, supposed that these columns were the remains of one hundred and twenty columns of Phrygian marble, with which the emperor Adrian had, according to Pausanius, adorned an edifice he had erected at Athens; and they suppose this Phrygian marble to be whiter than the marble of Pentelicus. But Phrygian marble is a species of alabaster variegated with beautiful veins and spots. Stephanus Byzantinus states, that Alabastra is a city of Phrygia, in which an excellent species of marble was found: and this is further confirmed by Strabo, who tells us that there were quarries near Synnada, a city of Phrygia, that afforded a sort of stone, variegated nearly in the manner of alabdstrites; and that columns and slabs of it, wonderful for their dimensions and beauty, were carried to Rome. Now, it is evident from Pliny, that the alabastrites which the Phrygian marble resembled, were diversified with various colours; so that Wheler and Spon were undoubtedly mistaken when they supposed that the said columns of Adrian, or, more properly speaking, of Jupiter Olympius, which are white, are of Phrygian marble, and that Phrygian is whiter than Pentelic marble. On the strictest examination, no difference could be discerned between the marble of these columns and that of the other buildings at Athens; 'we may therefore be certain that they were brought from Pentelicus, and not from Phrygia. For it is not credible that Adrian would have been at the expense of transporting from a distant country to Athens, a marble which the quarries of Attica afforded in great plenty and perfection.

Having thus proved that these columns could not be part of the temple of Jupiter Olympius, Stuart and Revett proceeded to inquire to what building they did really belong.

Pausanius afforded them some assistance in this inquiry: and by his description it should seem that the building in question can be no other than the celebrated portico called the Poikile. In his way from the Ceramicus and the temple of Vulcan to the Poikile, he passes near the Hermes Agoræus, or Mercury of the Agora; he then enters the Poikile, which he describes, and having finished his account of it, returns to the Agora, and enumerates various particulars he observed in that place. The manner in which Pausanius speaks of these buildings, and the transitions he makes from one to the other of them are such, that we must necessarily conclude them to be almost contiguous to each other. He then proceeds to the Gymnasium of Ptolemy, which he tells us, is not far from the Agora; and to the temple of Theseus, not far from the Gymnasium. Hence it appears that these three buildings, the Agora, the Poikile, and the Gymnasium of Ptolemy, stood near each other; and that the Agora was nearer than the Poikile both to the Ceramicus and to the Gymnasium; and that the Gymnasium lay between the Agora and the temple of Theseus.

Now the temple of Theseus still remains at Athens, and the sculptures on it are sufficient warrant for the name universally given to it. That temple therefore is a fixed and certain spot, concerning the situation of which there can be no dispute.

Not far from this temple of Theseus, are three of the most considerable ruins in Athens, standing together, and as it were in one group. One of these is the building under consideration, which, from the disposition of its plan, as we have already observed, appears to have been a stoa, or portico. Another is the doric portal, treated of in the first section, where it is proved to be, most probably, the Agora: and the third may be supposed, both on account of its situation and extent, to be the remains of the Gymnasium of Ptolemy; for it is the nearest of the three to the temple of Theseus, being, in fact, scarcely 700 feet distant from it. It lies between that building and the Agora, from which it is only 200 feet distant. Its plan, moreover, is a quadrangle, whose longest sides extended about 400, and its shortest sides 300 feet, a space well adapted to the uses of a Gymnasium.

To this circumstance of their vicinity may be added, that the respective situations of these ruins correspond with each other, and with the temple of Theseus, exactly in the manner that the Agora, Poikile, and the Gymnasium, correspond in Pausanius's description of them. For, going the nearest way from that part of the city, in which the Ceramicus stood, to the ruin here supposed to be the Poikile, the doric portico, which was shown to be most probably the Agora, is on the right hand; the ruin supposed to be the Gymnasium is on the left; and a little farther, but on the same side with the Agora, is that which is the subject of our present consideration. Again, if from the Agora, you go to the temple of Theseus, it is necessary to pass by the ruin here supposed to be the Gymnasium of Ptolemy. We may therefore conclude, that whatever proves any one of these ruins to be the remains of the building corresponding to it in Pausanius's description, will show, with the same degree of evidence, that the other two likewise correspond. For instance, the reasons alleged in the first section, to prove that the building there treated of was part of the Agora, prove equally that the other two are the remains of the Poikile and Gymnasium. Hence we may infer, that the ruin which is here the particular subject of our consideration, and which, from the disposition of its plan, appears to have been a stoa, or portico, was from its situation, and the richness of the architecture, that principal stoa called the Poikile.

Plate A^6, is a section of the front wall, with a profile of the portal, and of the southern pteroma, likewise one of the seven columns which are placed between the portal and the northern pteroma. The numbers, accompanied with asterisms, denote the depth of the channels of the rustic, and the projection of the different ornaments of the front wall.

The column nearest to the wall, is one of the seven which are placed between the portal and the northern pteroma; the corinthian pilaster, next it, is one of the antæ of the portal; the other corinthian pilaster, is that of the southern pteroma; and the column farthest distant from the wall, is one of the columns of the portal. The abacus of this capital, like that of the temple of Vesta, at Rome, has its angles acute, that is, they are not cut off as is generally practised There is a small fillet immediately above the astragal of the column, and eight short plain leaves, from which the usual leaves of the second range seem to spring. The profile of this entablature resembles that of the frontispiece of Nero at Rome. But no part of the mouldings are enriched, except the soffit of the corona.

6. The temple of Minerva called Parthenon, and Hecatompedon, was built during the administration of Pericles, who employed Callicrates and Ictinus as architects, under Phidias, to whom he committed the direction of all works of elegance and magnificence. It has been celebrated by some of the most eminent writers of antiquity, whose accounts are confirmed and illustrated in the descriptions given us by those travellers who saw it almost entire in the last century. Even in its present state, the spectator, on approaching it, will find himself not a little affected by so solemn an appearance of ruined grandeur. Accustomed as Stuart and Revett were to the ancient and modern magnificence of Rome, and by what they had heard and read, as also impressed with an advantageous opinion of what they had gone to see, they nevertheless found the image their fancy had preconceived, greatly inferior to the real object.

When sir George Wheler and Dr. Spon visited Athens, in the year 1676, this temple was entire; and the former has given the following description of it:—

"It is situated about the middle of the citadel, and consists altogether of admirable white marble. The plane of it is above twice as long as it is broad, being 217 feet 9 inches long, and 98 feet 6 inches broad. It hath an ascent every way of five degrees, or steps, which seem to be so contrived as to serve as a basis for the portico, which is supported by channelled pillars of the doric order, erected round upon them without any other basis. These pillars are forty-six in number, being eight to the front and as many behind, and seventeen on each side, counting the four corner ones twice over to be deducted. They are 42 feet high, and 17½ feet about. The distance from pillar to pillar is 7 feet 4 inches. This portico beareth up a front, and frieze round about the temple, charged with historical figures of admirable beauty and work. The figures of the front, which the ancients called the eagle, appear, though from that height, of the natural bigness, being in entire relievo, and wonderfully well carved. Pausanius saith no more of them, than that they concern the birth of the goddess Minerva. What I observed, and remembered of them, is this:—

"There is a figure that stands in the middle of it, having its right arm broken, which probably held the thunder. Its legs straddle at some distance from each other, where, without doubt, was placed the eagle: for his beard, and the majesty which the sculptor has expressed in his countenance, although those other usual characters be wanting here, do sufficiently show it to have been made for Jupiter. He stands naked, for so he was usually represented, especially by the Greeks. At his right hand is another figure, with its hands and arms broken off, covered half way, the legs in a posture as coming towards Jupiter; which, perhaps, was Victory, leading the horses of the triumphant chariot of Minerva, which follows it. The horses are made with such great art, that the sculptor seems to have outdone himself, by giving them a more than seeming life, such a vigour is expressed in each posture of their prancing and stamping, natural to generous horses. Minerva is next represented in the chariot, rather as the goddess of learning than of war without buckler, helmet, or a Medusa's head on her breast. Next behind her is another figure of a woman sitting with her head broken off: who it was is not certain; but my companion made me observe the next two figures, sitting in the corner, to be the emperor Adrian, and his empress Sabina; whom I easily knew to be so, by the many medals and statues I have seen of them. At the left hand of Jupiter are five or six other figures: my companion taketh them to be an assembly of the gods, where Jupiter introduceth Minerva, and owneth her for his daughter.

"The postick, or hind-front, was adorned with figures, expressing Minerva's contest with Neptune, about naming the city of Athens; but now all of them are fallen down, only a part of a sea-horse excepted. The architrave is also charged with a basso-relievo at several distances, divided into squares of about 2 or 3 feet broad, and 3 or 4 feet high. Within the portico on high, and on the outside of the cella of the temple itself, is another border of basso-relievo round about it, or, at least, on the north and south sides, which, without doubt, is as ancient as the temple, and of admirable work, but not so high a relievo as the other. Thereon are represented sacrifices, processions, and other ceremonies of the heathen worship. Most of them were designed by the marquis de Nantell, who employed a painter to do it two months together, and showed them to us when we waited on him at Constantinople.

"The cella of the temple without is 658 feet long, and broad 67 feet. Before you enter into the body of the temple from the front is the pronäos, whose roof is sustained by six channelled pillars of the same order and bigness with those of the portico, and contains near the third part of the cella; to wit, 44 feet of the length. We observed in place of one of the pillars, a great pile of stone and lime of most rude work; which, they told us, the Kisla Haga had ordered to be so done, to help to support the roof; because he could never find a stone big enough to supply the place of the old pillar broken down, although he had spent two thousand crowns to do it. From the pronäos we entered into the temple by a long door in the middle of the front. But my companion and I were not so much surprised with the obscurity of it as Monsieur Guiliter; because the observations we had made on other heathen temples did make it no new thing to us. When the christians consecrated it as a place of worship, they admitted light at the east end, which is all that it yet hath, and made a semi-circle for the holy place, according to their rites, which the Turks had not yet much altered. This was separated from the rest by jasper pillars; two of which on each side remain. Within this channel is a canopy sustained by four porphyry pillars, with beautiful white marble chapters of the corinthian order, but the holy table under it is removed. Beyond the canopy are two or three degrees one above another in a semi-circle, where the bishop and presbyters used to sit in time of communion, upon certain solemn days. The bishop sat in a marble chair above the rest; which yet remaineth above the degrees against the window On both sides, and towards the door, is a kind of gallery, made with two ranks of pillars, twenty-two below, and twenty-three above; the odd pillar is over the arch of the entrance, which was left for the passage. They showed us the place where two orange-trees of marble had stood, which being taken thence to be carried to Constantinople, the vessel miscarried with them. The roof over the altar and choir, added to the temple by the Greeks, hath the picture of the Holy Virgin on it, of mosaic work, left yet by the Turks. This temple was covered outwardly with great planks of stone, of which some have fallen down and are to be seen in the mosque."

Sir George Wheler copied this account from Dr. Spon, and added to it some mistakes of his own, which we have here omitted. Dr. Spon states, that the measures were taken in French feet; therefore, reckoning the diameters of the columns $5\frac{87}{100}$ such feet, the extent of the front between the outer surfaces of the angular columns reduced to English measure will be found to be nearly 102 feet 2 inches; and that of the side 225 feet $10\frac{1}{2}$ inches. But measures obtained by girting the circumferences of columns is little to be depended on.

In the year 1687, when Athens was besieged by the Venetians, under the command of the proveditore Morosini and count Koningsmark, an unlucky bomb fell on this admirable structure, and reduced it to the state in which it was seen by Stuart and Revett.

On their way from the city to this building, they passed by the theatre of Bacchus, and came to the Propylœa, which are miserably ruined: then, passing through a street of scattered houses, came to the western front of this temple, whose majestic appearance cannot easily be described. On this front, the walls with their antæ, and all the columns of the portico, with the entablature and pediment are still standing; and, though the sculpture in the metopes, and figures in the pediment are defaced and ruined, the architecture seems to have suffered but little.

The columns of the portico stand on a pavement raised three steps above the ground; and there are two more from the portico to the pronäos, or rather posticus, for the pronäos was in reality at the opposite front; and from this there is another little step, of little more than an inch in height, into the temple.

The inside of the temple was divided by a cross wall; and the smaller division, (the pavement of which is on a level with the little step last mentioned,) is the part into which a person first enters. Wheler and Spon have improperly called it the pronäos.

This was undoubtedly the opisthodomus where the public treasure was kept; there the columns mentioned by those travellers are no longer standing; but part of the rude mass said to have been erected by Kislà Agà is still to be seen. Hence the traveller passes into the greater division. At the western end of this, and on both the sides, the pavement of the opisthodomus is continued on the same level, to about 15 feet from the walls, and enclose an area, sunk a little more than an inch below it. In the area, and near the edge of this little step, are still to be seen certain circles, distinctly traced. On these, the columns of the peristyle that supported the galleries, mentioned by Wheler, were most likely placed: but these galleries, together with the walls of that part, and fourteen of the columns of the peripteros, are now no longer standing. The pavement is shown with pieces of sculpture, some of which are very large, and the whole of them are of excellent workmanship.

In this division stood the famous statue of Minerva, of ivory and gold, the work of Phidias. Pausanius states, that Minerva stood erect, with her garments reaching to her feet, a helmet on her head, and a Medusa's head on her breast; that in one hand she held a space, and on the other a figure of Victory, of about 4 cubits high. According to Pliny, the statue of Minerva was 26 cubits high: but in this account he probably included the pedestal, on which, according to the statements of both these authors, the birth of Pandora was represented.

We are not informed that the ivory was painted; though, from an observation of Strabo, that Pantanus, the brother or nephew of Phidias, assisted him in the colouring of the statue of Jupiter, at Elis which was likewise of ivory and gold, it is reasonable to conclude that it was. Ivory was used in statues of this kind, not so much on account of the colour, as from its being less liable to split and be destroyed by worms. For ivory is not of a uniform colour, being yellow near the outside and white in the middle; consequently, it requires to be painted on that account, as also to hide the joinings of the pieces.

Thucydides states that the gold about this statue weighed 40 talents, which, according to the value of gold at the present day, is equal to £120,000 sterling. Lachares stripped it off about one hundred and thirty years after the death of Pericles; and we do not read of its ever being replaced.

The eastern front of this temple hath suffered more than the western; as all the walls, and five of the columns of the pronäos are down: but the eight columns in front, with their entablature, remain pretty entire in their original situation, though much the greater part of the pediment is wanting.

The metopes on the south side were adorned with sculpture in alto-relievo of centaurs and lapithæ, some of which are not entirely defaced.

The outside of the cell was surrounded at the top with a continued frieze of about 3 feet 4 inches deep, representing the Panathenaic pomp or procession in basso-relievo. In the year 1674, the marquis de Nointel employed a young Flemish painter to copy this; two or three of whose drawings are represented in Montfaucon's "Antiquities."

Pausanius gives but a transient account of this temple, nor does he state whether Adrian repaired it, though the statue of that emperor, as also of his empress Sabina, are in the western pediment. This has occasioned a doubt whether the sculptures in both were not put up by him. Wheler and Spon were of this opinion, and state that they were whiter than the rest of the building; the statue of Antinous, also, still remaining at Rome, may be thought a proof that there were artists in his time capable of executing them. The whiteness of the marble, however, is no proof that they were more modern than the temple, for they might be made of a whiter marble: nor is the circumstance of the heads of Adrian and Sabina being there, any corroboration of the supposition, as it was not an uncommon practice among the Romans, and might have been practised in the present case, to affix heads to ancient figures. In addition to this, we may state from Plutarch, that the buildings of Pericles were not in the least impaired by age in his time; therefore, this temple could not want any material repairs in the reign of Adrian; unless, indeed, which is not probable, that the damage once sustained by the opisthodomus by fire, had remained unrepaired for so long a time.

Mr. Stuart has said that the lesser division of the temple was called the opisthodomus, where the public treasure was kept. Thucydides tells us, that it was kept in the Acropolis; and, having reckoned up what it amounted to, says, the riches out of *the other temples* may likewise be used, which implies, that the treasure, of which he had been speaking, was kept in a temple. Aristophanes places Plutus, the god of riches, in the opisthodomus of the temple of Minerva. His scholiast says, that this was the temple of Minerva Polias, which is a mistake, for that temple had only a single cell as will appear hereafter: nor could it be the temple meant by Thucydides, since it was not finished till after the death of Pericles, as appears by the inscription brought from Athens at the expense of the society of the dilettanti. Demosthenes calls the treasury opisthodomus, which properly signified the back of a temple; and Hesychius, Harpocration, Suidas, and the etymologist, agree that the Athenian treasury was in the opisthodomus of the temple of Minerva, which could be no other than this.

The third, fourth, and fifth marbles in the second part of Dr. Chalmers's "Inscriptions" are registers of the delivery of donations in this temple by the treasurers, to their successors in office. The third and fourth were found among its ruins. It is called Hecatompedon in both, and its opisthodomus is expressly mentioned in the latter. The fifth calls it Parthenon.

There is a passage in Vitruvius which most probably relates to this temple, and which proves it to have been an hypæthros. Vitruvius states, "that the hypæthros has ten columns in the pronäos and posticus, in all other respects it is like the dipteros; within, it has two rows of columns, one above the other, at a distance from the wall; so that you may pass round it as in the portico of peristyles; but in the middle it is open to the sky without a roof. The entrance is at each end, by doors in the pronäos and posticus. There is no example of this at Rome; but at Athens an octostyle in the Olympian temple."

From our quotation from Wheler it should appear, that when he saw the temple, it had within the cell on each side, two rows of columns, the one above the other, and standing at a distance from the wall. And by the decorations on the eastern front, it should further appear, that the principal entrance was originally placed there, though it has been since closed up, probably by the Greek christians, who could not otherwise have placed their communion table at the east end of the temple, which is a custom religiously observed by them: the door also in the western front was originally in that place, as is evident from the threshold or step leading into it still remaining. By this, therefore, the reader will perceive, that this temple agrees with what Vitruvius has delivered, and coincides with Mr. Stuart's opinion. The roof with which it was completely covered when Wheler and Spon, and other travellers, examined it, may seem to furnish a plausible objection to what has been here advanced; but as great additions and alterations have certainly been made, with a view to adapt it to the numerous ceremonies of the Greek ritual, and to the pompous functions of the archbishop and his attendant clergy, it is very probable that the roof was constructed at that time. This supposition acquires additional support, when we consider that the space between the columns did not much exceed 30 feet; and that it was necessary that this space should be covered in, before it could be fit for the reception of a christian congregation. The roofing it in would not have been more expensive, or have required greater skill in the execution, than the alterations which Wheler and Spon inform us were made in the eastern end.

From what Vitruvius has said, when speaking of the several deviations from the usual form of temples, another objection might be deduced. "Temples," says he, "are also built of other kinds, ordered with the same proportions, but differently disposed, as that of Castor in the Circus Flaminius, and that of Vejovis, between the two groves: ut, more ingeniously, that of Diana Memorensis, with columns added to the right and left on the shoulders of the ponäos; but this kind of temple, like that of Castor in the Circus, was first erected in the fortress of Athens to Minerva."

The reader may, perhaps, by remarking the similarity between the temples Vitruvius has here enumerated and that of the Minerva in the Acropolis, and by comparing it with what he has previously told us, that there was no hypæthros at Rome, suppose, that the temple of Minerva was not an hypæthros; but it should be remembered that he is in this place treating only of the disposition of the external columns.

It appears extraordinary, that in the account he has given of the hypæthros, the examples he produces should be exceptions to his doctrine; but we may be the less surprised at it, as the same unusual proceeding occurs in his account of the peripteros; and it is obvious, that an hypæthros having eight columns in front differs from one having ten only in this particular, that the exterior columns form a peripteros, instead of a dipteros, round the cell of the temple, as the marquis Galiani has observed in his comment on this place.

Plate A^{7}, is an elevation of the portico of the Parthenon. The dimensions marked on this plate were all taken on the western front, which is similar to the front facing the east, except only, that on the eastern architrave certain triangular holes are cut at regular distances, which are not repeated on the sides of the building, or on the front facing the west. It is difficult to assign any use for these holes, unless we suppose that cramps were fixed in them, to support some kind of ornament, probably festoons with which the eastern front, and that only, had been decorated.

Plate A^{8}. The capital and entablature of the columns of the portico.

7. The temple of Jupiter Olympius of which we have already spoken, in the fifth section, shall next claim our attention. A plan of it is inserted in plate A^{9}.

In the year 1753, when Stuart and Revett visited Athens, there remained but seventeen columns; thirteen of which, standing together in one group, without any intervening chasm, and connected together by their architraves, appear to have formed the southern angle of the front which faced the east; and furnished an unequivocal proof, that this temple was a *dipteros*, that is, the cell was surrounded by two rows of columns. These columns exceed 6 feet in diameter, and appear to be near 60 feet high. They are of Pentelic marble, fluted, with beautiful corinthian capitals, and attic bases, the outward row of which are distinguishable from those columns next the cell.

Three other columns, belonging to the inner row of the southern flank of the temple, were standing some distance from those above mentioned; and there remained one, marked F in the plan, which stood originally in the western portico. This last mentioned column proves that the temple, when entire, had one and twenty columns on its flank: for, if a right line be drawn from east to west, through the centres of the outward columns, it will cut exactly in the centre of the twentieth column of that row, by another line drawn at right angles to it from the centre of the column F, the base of which proves it was not in the front of the portico, but had another row of columns standing before it. There will therefore have been one and twenty columns on the flank of this magnificent temple; and consequently it was a *decastyle*, or had ten columns both in the portico and the posticus, which is the number Vitruvius has assigned to the complete hypæthros.

On this supposition, the front must have extended at least 167 feet, and the length from east to west have been 372 feet and some odd inches.

The peribolas, or wall, which enclosed the consecrated ground was, according to Pausanius, about four stadia, or half a mile in circumference; but Stuart and Revett could not entirely verify the statement. Stuart and Revett state, that their admeasurements were, for the extent from east to west, 682 feet 9 inches; and for the distance from the outward face of the southern wall of the peribolus to the basement on which the columns of the dipteros are set, 146 feet 2 inches; but that they were unable to ascertain its extent towards the north, as there was not on that side the least visible trace of the building. Pausanius enumerates other temples, statues, and monuments, that were within this peribolus, some of them accounted of great antiquity even in his time; and it can hardly be doubted but that the inside of this wall was adorned with a peristyle, or continued colonnade, with porticoes and other ornaments, so that the bare wall did not appear.

8. Of the temples of Erechtheus, Minerva Polias, and Pandrosus. To the north of the Parthenon, at the distance of about 150 feet, are the remains of three contiguous temples. That towards the east was called the Erechtheum: to the westward of this, but under the same roof, was the temple of Minerva, with the title Polias, as protectress of the city: and adjoining to it, on the south side, is the Pandrosium, so named because it was dedicated to the nymph Pandrosus, one of the daughters of Cecrops.

Pausanius has not given a more particular description of this building than he has of the Parthenon. He tells us that it was a double temple, and that in the Erechtheum was the spring of sea-water produced by the stroke of Neptune's trident, when he contended with Minerva for the patronage of the city. Before the entrance was an altar of Jupiter the Supreme; and within the temple an altar of Neptune, on which, by the command of an oracle, sacrifices were likewise made to Erechtheus. By this we may conclude that the temple was not originally dedicated to Erechtheus, but to Neptune. Besides these, there was an altar of the hero Butes, the brother of Erechtheus; and another on which sacrifices were made to Vulcan. On the wall were paintings, or inscriptions, relating to the family of Butes, in which family the priesthood was hereditary.

In the temple of Minerva Polias was an ancient statue of the goddess. It was of wood, and was said to have fallen from heaven. Stuart supposed it to have been one of those ancient statues which Pausanius mentions as being black, and, though entire, so scorched with the flames when Xerxes burnt the temple, that it could not resist a blow. In the temple was likewise a Hermes, or statue of Mercury, dedicated by Cecrops. It was almost hid from the sight by branches of myrtle, on account, it should seem, of the absurdity and indecency of such an image in the temple of a virgin. Superstition alone could have prevented the Athenians from removing it; for a Hermes appears to have been as obscene a figure as a Priapus. In this temple was likewise placed the golden lamp made by Callimachus, the inventor of the corinthian capital. This lamp, which was said to burn a whole year without a fresh supply of oil, was placed under a brazen palm-tree, the branches of which extended up to the roof, and conveyed away the smoke.

The Pandrosium is the only ancient example, with which we are acquainted, in which the entablature and roof are supported by caryatides. A plate of this beautiful portico has been given in Part 3.

Within the Pandrosium was an olive-tree, said to have been produced by Minerva, in the above cited contest with Neptune. It was called pankyphos, that is, incurvated, from its branches bending downwards after it had reached the roof. Under this tree stood an altar of Jupiter Herceus. Some have imagined that the olive-tree grew in the temple of Minerva Polias; but it is quite improbable that a tree should grow in a place so unfavourable to vegetation. The temple of Minerva Polias appears to have been a close room, illuminated only by a single lamp; whereas in that of the Pandrosium the spaces between the caryatides was left open, for the free admission of light and air.

The olive-tree and the spring of sea-water prove this to be the fabulous scene of contention between the two divinities: as also that these temples were erected on the precise spot as that on which the temples burned by Xerxes had originally stood. The original temples were of great antiquity, probably the most ancient in Athens: for Homer mentions that of Minerva, under which name he seems to include the three, as Herodotus afterwards similarly includes them under the name of Erechtheus.

An inscription brought from Athens, at the expense of the society of dilettanti, and published by Dr. Chandler, contains a survey of such parts of these temples as were at that time unfinished, with what seems to be an estimate in attic minas of the expense of completing them, amounting to between three and four hundred pounds sterling.

This survey was taken by order of the people of Athens when Diocles was archon, which was in the twenty-third year of the Peleponnesian war. Hence it is not improbable, that this building was begun during the administration of Pericles, and that a stop was put to it either through his death, or the calamities and expenses of that war.

By the grammatical inaccuracies in this description, it seems to have been drawn up by the mason employed in the survey. And as many of the architectural terms used in the inscription are not to be found in any writer now remaining, together with our ignorance of the manner in which the survey was taken, whether it were by going round the building, or classing similar deficiencies together, render it now very obscure, and in a great measure unintelligible.

The situation of some of the most unfinished parts is described as being near the Cecropium; of others near the Pandrosium; some on the south wall; others on the east. By the Cecropium, it is supposed, is meant the temple of Minerva Polias, which might have been so called, from the opinion that Cecrops was buried there; as the contiguous temple of Neptune, probably for a like reason, was called the Erechtheum. We read of no other building being called Cecropium. The Acropolis, which was the ancient city, and said to have been built by Cecrops, was called Cecropia.

In this survey no part of the Cecropium, or of the Pandrosium, is said to be unfinished. In the forty-fourth line, it mentions columns on the wall next the Pandrosium; and in the sixty-second, pilasters next to the Cecropium; and some other particulars are also mentioned which seem to belong to the present building, but the measures assigned to them prove the contrary.

This circumstance is a confirmation of a passage in Xenophon, which states, that this temple was burnt about three years after the survey was taken, though the names of the archon and ephorus are generally believed to be interpolated.

These temples are now in a very ruinous condition. Those of Erechtheus and Minerva have no roof or covering of any kind. The wall which separated them, as also that by which the pronäos or passage to the Pandrosium was parted off from the temple of Minerva, are so demolished, that scarcely any traces of them remain, excepting where they join the side walls. The pavements are so encumbered with large blocks of marble and rubbish, as to render the inside almost impassable. The Pandrosium, though it has suffered the least, is filled up to a great height in the same manner, and one of the caryatides is wanting. Stuart and Revett found the portico of Minerva Polias walled up; and being a magazine of military stores, admittance was denied them.

Although these three temples compose one body, they are not on the same level; for the pavement of the temple of Erechtheus is about 8 feet higher than that of the rest of the building. Neither has the architect attempted to form them into one regular whole, but seems purposely to have kept them, as we now see them, in three distinct forms.

In Plate A^{10}. is represented the plan of the three contiguous temples.

A, the temple of Erechtheus, or of Neptune, in which was a well of salt water, and the altars of Neptune, Vulcan, and the hero Butes. Before it stood the altar of Jupiter the Supreme.

B, the temple of Minerva Polias; perhaps the Cecropium of the dilettanti inscription.

a a, the wall which separated the two temples; distinctly visible where it joined the lateral walls.

C, the temple of Pandrosus; in which was the olive-tree said to be produced by Minerva, and the altar of Jupiter Herceus.

D, the portico, common to the temple of Minerva and to that of Pandrosus.

EE, a kind of vestibule, or pronăos, which likewise was common to the two last mentioned temples, and the only approach by which either of them could be visited.

bb, vestiges of the wall which separated the vestibule from the temple of Minerva.

The part shadowed with diagonal lines lies about 8 feet lower than the unshadowed part, and distinguishes the level on which the temple of Minerva Polias is built from the higher ground on which the Erechtheum stands.

FF, foundations of a wall continued from the basement of the Pandrosium to some distance westward. It stood on the extreme edge of a little precipice, which in this part separates the upper level from the lower.

d d, vestiges near the portico of the Erechtheum of a division between the upper and lower ground, similar to that mentioned in the preceding reference.

Plate A^{11}, elevation of the portico of the temple of Erechtheus. On the left hand is the flank of the portico of Minerva Polias: the dotted line, *aa*, marks the level on which that portico is built. On the left hand is the flank of the Pandrosium.

Plate A^{12}, the capital base and entablature of the portico of Minerva Polias.

Plate A^{13}. Fig 1 and 2, the capital and base of the antæ. Fig. 3, profile of the moulding under the corona. Fig. 4, the same viewed from below, to show the effect of the flower on the angle. The other figures represent the plan reversed and the necessary sections of the capital.

Plate A^{14}, the ionic volute of the temple of Minerva Polias described.

In Part 3, has been given under the word *Pandrosium* the elevation of the front of the temple of Pandrosus adorned with caryatides: and in Part 2 and 3, three plates have been given, showing the caryatides on a larger scale.

9. Of the choragic monument of Thrasyllus. Just above the place on which Mr. Stuart has supposed the odeum of Pericles to have been built, there is in the rock of Acropolis a cavern or grotto, the entrance to which is completely fronted and closed by the choragic monument of Lysicrates. This cavern is now converted into a christian church, called "*Panagia Spiliotissa,*" or the blessed lady of the grotto.

On the front of the building are three inscriptions, recording victories obtained in the odeum or the theatre, which prove it to be a choragic monument; not indeed so highly ornamented as the monument of Lysicrates, but nevertheless wrought with great accuracy, and deserving of our notice, both for the singularity of the composition and the form of the mouldings..

There is an inscription on the architrave to the following effect: "Thrasyllus, the son of Thrasyllus of Decelia (a demos or borough town of the tribe of Hippothoon), dedicates this building, having been at the expense of exhibiting the games in which he, with the men of his own tribe, obtained the victory. Evius, of Chalcis, was the musician; and Karchidamus, the son of Sotis, composed the piece; Nechæmus being archon." This was in the first year of the hundred and fifteenth olympiad, or about three hundred and eighteen years before the christian era; so that this building was erected above two thousand years ago.

The other two inscriptions, which may be thus translated,

"*The people gave the games; Pytharatus was archon;*
Thrasycles, the son of Thrasyllus, a Decelian, was agonothetes;
The boys of the tribe of Hippothoon gained the victory;
Theon, the Theban, performed on the flute;
Pronomus, the Theban, composed the piece.

and

"*The people gave the games; Pytharatus was archon;*
Thrasycles, the son of Thrasyllus, a Decelian, was agonothetes;
The men of the tribe of Pandion gained the victory;
Nicocles, the Ambracian, performed on the flute;
Lysippus, the Arcadian, composed the piece."

record victories of the same kind as the former, obtained about fifty years afterwards, when Pytharatus was archon.

Over this building, but higher up the rock, stand two columns of different heights. The diameter of the tallest measures about 4 feet 2 inches and 2-10ths; and that of the other, 3 feet 4-10ths of an inch. They have never belonged to the building, and are each of them insulated, being erected for the sole purpose of supporting a tripod, as is evident from the form of their capitals. They are of a triangular shape, like that of the flower on the dome of the monument of Lysicrates, and like that, have cavities sunk in their upper surfaces at each of their angles. In these cavities were doubtless fixed the feet of the tripods. The capitals are of uncommon forms; but, though adorned with foliage and volutes, are not to be admired for any elegance of invention, or delicacy of workmanship.

On the plinth of the eastern, and tallest of these columns is inscribed ΣΤΡΑΤΟΝΕΙΚΟΣ, probably the name of the person who dedicated the tripod; but, as the name of the archon is wanting, the date cannot be ascertained, unless we suppose it to have been erected in the year of anarchy, that is, in the first of the ninety-fourth olympiad; for even at that disastrous period, the Athenians seem to have solemnized their festivals, and to have indulged themselves in their accustomed amusements.

In Plate A^{15}, is represented the elevation of the front of this monument; and in Part 3, the capital and entablature have been given on a larger scale.

10. Of the temple of Theseus. The travellers who have visited the city of Athens, and the authors who have described its antiquities, agree, that this doric temple, which is one of the noblest remains of ancient magnificence, and at present the most entire, was built in honour of Theseus. This opinion is justified by the sculptures in the metopes, several of which, though mutilated, represent the exploits of that hero.

The circumstances which led to the construction of this building took place, according to Plutarch, in the year that Aphepsion was archon; which was about the fourth year of the seventy-seventh olympiad, or four hundred and sixty-seven years before Christ; consequently, this temple may be accounted one of the works of the age of Pericles.

It is built of pentelic marble; and. in the language of Vitruvius, is a peripteros; that is, it has a portico of six columns in each front, and on each side a range of eleven columns, exclusive indeed of the columns on the angles, in which particular the Greeks differed from the Romans, who included the columns on the angles in the number eleven. The distance of the lateral columns from the wall of the cell, is somewhat more than the space of one intercolumniation; they connect the two porticoes, and by that means complete a covered walk round the cell of the temple.

The principal front faces the east; and the pediment of the front appears to have been adorned, like the Parthenon, with figures of entire relief, fixed similarly in their places by cramps of metal. Several holes, in which the cramps were inserted, remain in the face of the pediment, though the figures which they had supported are entirely destroyed.

On the metopes of this front are represented ten of the labours of Hercules: and on the four metopes next this front, on the northern and southern sides, are represented eight of the achievements of Theseus. It may at first appear somewhat extraordinary, that the labours of Hercules should make so considerable a part of the ornaments of this temple; but when we consider the respect and gratitude professed by Theseus for that hero, who was his kinsman, and had restored him from a tedious captivity to his friends and country; as also, that Theseus, on his return, did consecrate to Hercules, with the exception of four, all the places which the gratitude of the citizens had formerly dedicated to himself, the impression will wear off. Nor could it have been esteemed a slight honour to Theseus, to have his labours placed in conjunction with those of Hercules.

The remainder of the metopes, and the pediment of the posticus, or western front, have never been adorned with sculptures.

This temple is now converted into a church, and dedicated to St. George; for whom the present Athenians seem to have as high a veneration, as their ancestors had for Theseus.

The sculpture on the frieze over the antæ of the pronäos represents a battle and a victory. It seems to record an action of great importance, for it is honoured with the presence of six divinities; three of whom, though somewhat defaced, are yet to be distinguished for Jupiter, Juno, and Minerva. Amongst the combatants there is one of superior dignity, more vigorous exertion, and of more ample stature, arrayed in a long robe, which trails behind him, and in the act of hurling a stone of a prodigious size at his adversaries: this, probably, represents the phantom of Theseus rushing impetuously on the Persians at the battle of Marathon. His miraculous apparition and interposition at that battle was firmly believed by the Athenians, and was one inducement to the building of this temple. The victory of Marathon was certainly one of the most glorious of the Athenian achievements; and there is a sort of modesty as well as piety, in their attributing to the gods and the assistance of their hero this amazing victory, rather than to their own valour. The last figure on the frieze was evidently employed in erecting a trophy.

The sculpture on the frieze over the antæ of the posticus represents the battle of the centaurs and lapithæ. Amongst the combatants one hero alone has thrown a centaur to the ground, and is in the act of killing him. This hero is probably intended for Theseus. In the middle of this piece of sculpture is Caneus, who, being invulnerable by weapons, is overwhelmed by a huge piece of rock, with which two centaurs are about to crush him. This circumstance is introduced by Ovid, in the description he makes Nestor give of the centaurs and lapithæ.

It may be proper to observe, that the sculpture on this temple is very fine and much relieved, the limbs being in many places entirely detached, which is, perhaps, one reason that they are so much damaged.

Plate A^{16}. represents an elevation of the eastern front.

11. Of the arch of Theseus, or of Hadrian. This arch stands nearly north-east and south-west, and is about a quarter of a mile south-eastward from the Acropolis. The front facing that building has an inscription to the following effect:

"*This is Athens, formerly the city of Theseus.*"

And that next to the Ilissus, the channel of which lies to the south of it, at less than a quarter of a mile distance, is another inscription to this effect:

"*This is the city of Hadrian, and not of Theseus.*"

Both fronts are adorned with corinthian columns, and are, in all parts, perfectly similar. It is of pentelic marble, and, like the other ancient edifices of Athens is built without the aid of mortar or cement, the blocks of marble being connected together by cramps of metal. This arch evidently appears neither to have been connected with, or to have belonged to, any other building; and to have been originally intended to remain insulated. It appears, however, extraordinary, that it should stand so near, and be situated so obliquely to the remains of the peribolus, or wall, that encompassed the temple of Olympium; and it is difficult to reconcile its situation to any idea of beauty or convenience, or to conceive the motive that induced the Athenians to place it here.

Notwithstanding that the inscription states the emperor Hadrian to be the founder of at least the southern part of Athens, it should seem, from arguments furnished by Mr. Stuart, that it is rather a complimentary effusion of Athenian gratitude to so liberal a benefactor than an absolute truth, or the record of an historical fact.

The situation of the arch of Ægeus and that of Hadrian appearing to coincide, Mr. Stuart has supposed that the subject of the present section is, in fact, no other than the arch of Ægeus, probably rebuilt by Hadrian on the identical spot on which the former, venerable for its antiquity, had stood. Mr. Stuart has also supposed, that the north-western angle of the peribolus of the Olympium has been cut off by a wall running parallel to this arch, which, by that means, became an additional ornament to the enclosure, in which, not only the magnificent temple of Jupiter Olympius, built by Hadrian, but many other monuments of much higher antiquity were contained. This opinion is strengthened by the unconnected state of the arch, and the obliquity of its position.

Plate A[17], is an elevation of the front facing the south-east.

The preceding information relates to the state of Athens at the time that Messrs. Stuart and Revett visited it in the year 1759; but considerable alterations having taken place since that period, particularly the transportation of some of the most beautiful parts of those edifices to the British metropolis, we consider it our duty to detail to the reader the particulars which led to the deposit of those works in the British Museum.

In the year 1799, lord Elgin was appointed his majesty's ambassador extraordinary to the Ottoman Porte; and being sensible that the artists of this country would derive material improvement from the study of the most celebrated works of antiquity, he proposed to his majesty's government, that they should send out persons of acknowledged eminence, to make exact measurements and designs of the buildings at Athens. This being objected to, partly from the doubtful issue of the undertaking, and partly from the expense attending it, his lordship endeavoured to procure, at his own charge, some artists from this country; but finding the value of their time far beyond his means of liquidation, he found himself reduced to the necessity of having recourse to the artists of other countries. These were Don Tita Lusieri, of Sicily, one of the best general painters in Europe, to undertake the execution of the plan; Signor Balestra, a distinguished architect, and Ittar, a young man of promising talents, both of Rome, to undertake the architectural part; Theodore, a Calmouk, who, during several years' stay at Rome, had shown himself equal to the first masters in the design of the human figure; and two Italian *formatori*, to make the madreformi for the casts.

These artists prosecuted the undertaking with the greatest diligence and skill, so that in the course of three years every monument of which there were any remains to be found was measured with the utmost precision; and from the rough draughts of the architects, finished drawings have been made by them of the plans, elevations, and details of the most remarkable objects; in which the Calmouk has restored and inserted all the sculpture, with exquisite taste and ability. He has, besides, made accurate drawings of the bas-reliefs on the several temples, in the precise state of decay and mutilation in which they at present exist. Most of the bas-reliefs, and nearly all the characteristic features of architecture, in the various monuments at Athens, have been moulded, and the moulds brought to London.

Besides the architecture and sculpture at Athens, all similar remains which could be traced through several other parts of Greece, have been measured and delineated with the most scrupulous exactness by the second architect, Ittar. And picturesque views of Athens, of Constantinople, of various parts of Greece, and of the islands of the Archipelago, have been executed by Don Tita Lusieri.

In the prosecution of this undertaking, the artists had the mortification of witnessing the very wilful devastation to which all the sculpture, and even the architecture, was daily exposed, on the part of the Turks, and travellers. The former influenced by mischief and avarice; the latter from an anxious desire to become possessed, each according to his means, of some relic, however small, of buildings or statues which had formed the pride of Greece. Many of the buildings which were in Stuart's time in a state of tolerable preservation had so entirely disappeared, that their foundations were no longer visible. This induced lord Elgin to endeavour to preserve, by removal from Athens, as many of the specimens of architecture and sculpture as he could without injury rescue from such impending ruin. The removal of them from Athens to London cost his lordship no less a sum, including the interest of money, than one hundred and thirty-five thousand pounds. They are now deposited in the gallery of antiquities in the British Museum; and consist principally of the undermentioned:—

Fifteen of the metopes belonging to the Parthenon, which, alternately with the triglyphs, ornamented the frieze of the entablature surmounting the colonnade, representing the battle between the centaurs and lapithæ. The exterior frieze of the cella of the Parthenon, which embellished the upper part of the walls, within the colonnade, at the height of the frieze of the pronäos, and which was continued in an uninterrupted series of sculpture entirely round the temple, representing the sacred procession which took place at Athens every fifth year, at the festival of the great Panathenæa, in honour of Minerva; and that portion of the abovementioned frieze, which occupied the east end of the temple, representing divinities and deified heroes. Also a portion of the same frieze, taken from the north side of the temple, representing two of the *metœci*, or strangers, who settled at Athens, and were allowed to take part in the procession, together with charioteers and horsemen. Other slabs of the frieze, from the south and west sides, representing a procession of victims, charioteers, and horsemen; that of the south side being very similar in its general character and appearance to the frieze on the opposite or north side. From the pediment of the Parthenon, on which was represented the birth of Minerva, and the supposed contest between Minerva and Neptune for the honour of naming the city, there are many very excellent figures, particularly the recumbent statue of the river god Ilyssus, and that of Theseus the Athenian hero.

There are also casts in plaster from the frieze of the pronäos and posticus of the temple of Theseus; and from the choragic monument of Lysicrates. Also the capital of an ionic column from the portico of the Erechtheum; pieces of the architrave, a portion of the cornice, and four pieces of the frieze, all from the same temple of Erechtheus. Also various pieces of the shafts and capitals of doric and ionic columns; and one of the caryatides which supported the roof, under which the olive-tree of Minerva was sheltered, in the temple of Pandrosus.

These excellent remains of antiquity, of which we cannot speak too highly, have been very differently valued by the gentlemen who had to give in their estimates to parliament; Mr. Knight valued them at £25,000; Mr. Hamilton at £60,800; and the earl of Aberdeen named £35,000, as a sort of conjectural estimate of the whole.

The various items of those estimates we here subjoin:

ATHENIAN ARCHITECTURE.

Mr. Knight's Valuation.

Recumbent statue of Hercules, as on the coins of brass, with little of the surface remaining,	1,500
Trunk of a male statue recumbent,	1,500
Back and shoulders of a trunk on which the head of Hadrian appears to have been,	1,200
Fragment of a horse, very fine,	250
Fragments of about ten draped trunks from the pediment of the Parthenon, most of which appear to be of the age of Hadrian,	2,000
Fourteen metopes, of various degrees of merit, all corroded, and mostly much mutilated,	7,000
Twelve pieces of the frieze of the cell with parts entire,	3,600
About thirty-five more, completely ruined,	1,400
Plaster casts from ditto, and other temples,	2,500
A granite scarabæus,	300
A white marble soras, complete and entire, but coarse,	500
Various shafts and blocks of marble,	350
Ditto of porphyry,	350
Various fragments of statuary and relief,	500
Ditto architecture,	300
Caryatides from the propylæa, much injured,	200
Nine broken marble urns,	450
One wrought brass ditto,	150
One inscribed earthen ditto,	150
Inscriptions on marble,	300
Medals.	1,000
	£25,500

Mr. Hamilton's Valuation.

Theseus,	4,000
Ilyssus,	4,000
Female group,	4,000
Ditto,	4,000
Iris,	2,000
Three horses' heads	2,000
Torso of Neptune,	500
Remainder of the pediment,	2,000
For the pediment,	£22,500
Metopes (nineteen),	10,000
Fifty-three pieces, at £400	20,300
Bacchus,	1,000
Cariates,	700
Casts from the Parthenon,	1,000
Carried forward	£55,500

Brought forward	55,500
Doric columns and architecture,	400
Ionic ditto,	800
Inscriptions,	2,000
Etruscan bas-relievoes,	200
Vases from Athens,	400
Bronze vase,	200
Medals,	800
Drawings,	500
	£60,800

Atlases, or atlantides. The name given by the Greeks to the statues of men which supported entablatures with mutules: they were otherwise called by the Greeks, "Persians," and by the Romans, "Telamones." Plate I^{8}. These three figures are from designs by Michael Angelo Buonarotti. The middle figure may be employed in buildings; the other two in the angles of coved ceilings.

Atrium. A court surrounded by porticoes in the interior division of ancient Roman houses.

According to Vitruvius, the proportions of the Atrium were determined in three several ways: first, in some the width was three-fifths of the length; secondly, in others, it was but two-thirds of the length; and thirdly, in others, the width was proportioned to the length, by describing a square, each of whose sides was equal to the width, and the diagonal of that square determined the length of the atrium. That side of the atrium opposite to the gate was called *tablinum*; and the other two sides *alæ*, or wings.

The width of the alæ, or wings, on the right and left, was proportioned to the length of the atrium. If the length was from 30 to 40 feet, the width of the alæ was one-third; if from 40 to 50 feet, the length was divided into three parts and a half, of which one part gave the width for the alæ; if from 50 to 60 feet the alæ was a fourth part of the length; if from 60 to 80 feet, the length was divided into four parts and a half, of which the width of the alæ was equal to one part or two-ninths of the whole; and if the length of the atrium was from 80 to 100 feet, the width of the alæ on the right and left was just one-fifth of that extent. The *trabes*, or lintel-beams, extending from column to column of the alæ, were made as high as they were wide.

When the atrium was 20 feet wide, the *tablinum*, or place appropriated for the preservation of the family records, was made two-thirds of it; when from 30 to 40 feet, the tablinum was half the width; and when from 40 to 60, the width was divided into five parts, two parts being given to the tablinum. Atria of small dimensions could not with propriety have the same proportions as those which were more spacious; because if the proportions of the greater be used in the less, neither the tablinum nor alæ could be convenient; and if the proportions assigned to the less be used for the greater, the members would be huge and enormous. Vitruvius has, therefore, in the above, assigned to each their respective proportions, both as regards their utility and appearance.

The height of the beams of the tablinum was one-eighth, and that of the lacanariæ one-third more than the breadth. The *fauces*, or entrance, in atria, of small dimensions was one-third, and in atria of large dimensions one-half, of the width of the tablinum; and the height of the images, with their ornaments, was determined by the breadth of the alæ.

The proportions of the height and width of the doorways depended upon the order of architecture, whether doric or ionic, and was regulated by the established proportions of that particular order of which the doorway was constructed

As many persons have confounded together the terms atrium and vestibulum, supposing them to be one and the same place, we have given a plan of an ancient Roman magistrate's house, by reference to which the reader will perceive, that the vestibulum was not a part of the interior of the house, but a large recess at the principal entrance, analogous, perhaps, to the *loggias* of modern Italy. See Plate P ^{3}, *a*, the vestibulum; *b*, the atrium; *c*, the tablinum; *dd*, alæ; *ee*, domestic offices; *f*, the cavædium; *g*, the triclinium; *h*, the procœton; *i*, bathing apartments; *k*, the cubiculi: *l*, the basilica; *m*, the pinacotheca; *n*, the libraries; *o*, the peristylium; *p*, servants' rooms; *q*, the Egyptian œcus; *r*, the corinthian œcus; *s*, the tetrastyle œcus; and *t*, the cyzicene œcus.

Atrium. *In ecclesiastical antiquity*. An open space or court before a church, making part of what was called the *narthex*, or anti-temple. It was surrounded by a portico or cloister, and was situate between the porch and body of the church. In the atrium stood the first class of penitents, to beg the prayers of the faithful as they went into the church.

Attic. A term that expresses any thing invented or much used in Attica, or the city of Athens.

Attic. A low story erected over an order of architecture, to finish the upper part of the building, being chiefly used to conceal the roof, and give greater dignity to the design.

The rules assigned by architects for the proportions of the attic are various. Some make the height equal to one-half, and others only to one-third of the principal order. It is usually decorated with pilasters, which are sometimes plain, and at other times panelled. They have no diminution, nor have they any peculiar base or capital. Attics are much used by modern architects, particularly by the Italians; and when applied to modern buildings frequently have windows in the podium or dado.

Attic, or atticurgic base. Consists of an upper and lower torus, a scotia, and fillets between them. Vitruvius, speaking of the bases of columns, says, "the bases are fixed in their places, and are so proportioned, that, including their plinth, they have in height half the thickness of the column; and in projection, which the Greeks call *εκφοραν*, *ekphoran*. They should have one quarter of the thickness of the column; so that their breadth and length will be once and a half the thickness of the column. Their height, if they are to be in the attic mode, is so divided that the upper part is one-third of the thickness of the column, and the remainder is left for the plinth. The plinth being excluded, the remaining part is divided into four parts, and the upper torus has one of them; the remaining three parts are equally halved, and one-half makes the lower torus, and the other the scotia, which the Greeks call, τροχιλον, *trochilon*, with its squares."

In ancient examples of the ionic and corinthian orders, both among the Greeks and Romans, the attic base is frequently to be found; but the proportions of its parts varies in almost every example. The attic base is extremely beautiful, and is as much the favourite of the moderns as it was of the ancients. See Plate B^1. *Bases.*

Attic, or atticurgic door. See *Door*.

Attic order. A term used by some authors to denote the pilasters employed in the decoration of an attic story. It appears, however, to be used improperly, as it wants the parts that are essentially necessary to constitute an order, such as the capital, base, entablature, &c.

Attic story. A term frequently applied to the upper story of a house.

Attributes. *In Painting and Sculpture.* Symbols given to figures and statues to indicate their office and character. For example, the palm is an attribute of victory; the trident, of Neptune; the olive branch, of peace; and the club is an attribute of Hercules.

Auditory. A seat or bench where a magistrate or judge hears causes.

Auditory. *In ancient churches.* That part of a church where the people usually stood to be instructed in the gospel; it is now called the *nave*.

Auger. A tool used by carpenters and joiners for the boring of large holes. It consists of an iron spindle, terminating at the one end with steel, and at the other with a wooden handle. The steel end of the spindle is pointed and sharpened like a centre-bit, one extremity of the edges being made to cut the wood at the circumference; and the other to cut and take away the cone the whole length of the radius. See Plate T^1. *Tools.*

Aviary. A large cage or apartment for breeding birds.

Aula. A court or hall in ancient Roman houses.

Axal. Relating to the axis.

Axal section. A section through the axis of a body.

Axe. A tool used in the hewing of timber. It consists of a cutting edge with a long wooden handle, which is usually grasped by both hands during the operation of cutting. There is a difference between the adze and the axe: the former being employed in forming horizontal surfaces; and the latter for cutting timber in a vertical direction. Axes are also used by bricklayers and stonecutters, the forms of which are varied, according to the quality of the materials upon which they have to act.

Axis. The spindle or centre of any rotative motion. In a sphere, a line passing through the centre is the axis.

Axis of a cone. See *Cone.*

Axis of a conic section. See *Conic Section.*

Axis of a cylinder. See *Cylinder.*

B.

Babel. A city and tower built by Noah's posterity in the plains of Shinah. Its precise situation is not ascertained. It was, however, within the province of Shinah, and probably ancient Babylon was erected on or near to its ruins. Some have supposed, that a shapeless heap of ruins, lying about eight or nine miles to the north-west of Bagdad, is the remains of that celebrated tower.

According to the scripture, the materials of which this building was constructed were burnt bricks instead of stone, and slime instead of mortar. The slime was of a pitchy or bituminous nature, brought from a city in the neighbourhood of Babylon, called Is or Hit.

Back. When any piece of timber is placed in a level or an inclined position, the upper side is called the back; and the lower side, the breast.

Back of a hand-rail. From the preceding definition it is evident, that the upper side of the hand-rail is called the back.

Back of a hip rafter. See *Hip Roof.*

Back of a rafter. The upper side of a rafter.

Back lining of a sash frame. See *Sash Frame.*

Back shutters. Shutters for the principal rooms of houses are generally made in halves: the one-half being fixed to the one side of a window, the other half on the side exactly opposite; so that when the halves are brought towards each other, and are in one plane, they close, and effectually shut out the light. Each of the halves consist of two, three, or more pieces of joinery, connected together by hinges, to admit of their being folded behind each other, so as to fall back into a box or recess made for their reception. When thus folded back, that division of the shutters which is visible is called the front-shutters; and that division or divisions which is confined in the recess, the back-shutters, or back-flaps. Back-shutters are usually made thinner than the front-shutters, and are framed with bead and butt.

Back of a wall. See *Backing of a Wall.*

Back of a window. That piece of joinery, or wainscoting, which is in the intermediate space between the bottom of the sash frame and the floor of an apartment; being confined in its length by the two elbows. This wainscoting has commonly but one panel; though under large windows it has sometimes two and even three panels. The mouldings on the framing of these panels are made to correspond with the mouldings on the elbows, shutters, doors, soffits, &c. of the same apartment.

Backing of a rafter or rib. The forming of an upper or outer surface, that it may range with the edges of the ribs or rafters on either side. See *Edging*, and *Ranging.*

Backing of a wall. The inner face of a wall; or the art of building the inner face.

Badigeon. A mixture of plaster and free-stone, well sifted and ground together: it is used by statuaries to fill up the little holes, and repair the defects, in stones of which their work is made. Joiners apply this term to a mixture of saw-dust and strong glue, wherewith they fill up the chaps and other defects of wood, after it has been wrought. They also use for the same purpose a mixture of whiting and glue; and sometimes putty and chalk. When the first of these two last mentioned is used, it is usual to allow it to remain till it is quite hard, before it is submitted to the operation of planing or smoothing; as, otherwise, it is apt to shrink below the surface of the work.

Bagnio. An Italian term for a bath. The English apply this term to a house which hath conveniences for bathing, sweating, and otherwise cleansing the body; the Turks apply it to the prisons where their slaves are confined, in which prisons it is customary to have baths.

Baguette. A small astragal moulding, sometimes carved and enriched with pearls, ribands, laurels, &c. According to M. le Clerc, when the baguette is enriched with ornaments it is called a *chaplet;* and when plain, it is a *bead.*

Bakehouse. A house, or apartment, for baking. See *Oven.*

Balaneia. A Greek term for a bath.

Balbec, or baalbeck. A famous city of Syria; implying in the Syrian language, *the city of Baal or the Sun.* It was also celebrated by the Greeks and Latins under the term *Heliopolis,* which word is analogous to the Syrian "Balbec." It is pleasantly situate near the north-east extremity of the valley of Bocat, or Bekaa, at the foot of mount Anti-Libanus, on the last rising ground where the mountain terminates in the plain. It is well watered by the Litane, rising from Anti-Libanus, and the Barbouni from the foot of Libanus; and it abounds in gardens. It is distant from Damascus about fifty miles to the north-west; and it is about thirty miles from the nearest sea-coast, which is the site of the ancient Byblus.

Balbec has long been famed for her architectural antiquities. Pursuing the plan, therefore, which we have adopted with respect to Athenian architecture, we purpose, in this place, to detail to the reader some of the most valuable information relating to this city, depending principally upon the accredited accounts of Mr. Robert Wood, which were published through the liberality of Mr. Dawkins, who visited Balbec in 1751; and those of M. Volney, in his travels in Egypt and Syria.

"As we arrive," says Volney, "from the south, we discover the city at the distance of only a league and a half, behind a hedge of trees, over the verdant tops of which appears a white edging of domes and minarets. After an hour's journey we reach these trees, which are fine walnuts; and soon after, crossing some ill-cultivated gardens, by winding paths arrive at the entrance of the city. We there perceived a ruined wall, flanked with square towers, which ascends the acclivity to the right, and traces the precincts of the ancient city. This wall, which is only 10 or 12 feet high, permits us to have a view of those void spaces, and heaps of ruins which are the invariable appendage of every Turkish city: but what principally attracts our attention, is a large edifice on the left, which, by its lofty walls and rich columns, manifestly appears to be one of those temples which antiquity has left for our admiration. These ruins, which are some of the most beautiful and best preserved in Asia, merit a particular description.

"To give a just idea of them, we must suppose ourselves descending from the interior of the town. After having crossed the rubbish and huts with which it is filled we arrive at a vacant place, which appears to have been a square; there, in front towards the west, we perceive a grand ruin, which consists of two pavilions ornamented with pilasters, joined at their bottom angles by a wall 160 feet in length. This front commands the open country from a sort of terrace, on the edge of which we distinguish with difficulty the bases of twelve columns, which formerly extended from one pavilion to the other, and formed a portico. The principal gate is obstructed by heaps of stones; but that obstacle surmounted, we enter an empty space, which is a hexagonal court of 180 feet diameter. This court is strewed with broken columns, mutilated capitals, and the remains of pilasters, entablatures, and cornices; around is a row of ruined edifices, which display all the ornaments of the richest architecture. At the end of this court, opposite the west, is an outlet which formerly was a gate, through which we perceive a still more extensive range of ruins, whose magnificence strongly excites curiosity. To have a full prospect of these we must ascend a slope, up which were the steps to this gate, and we then arrive at the entrance of a square court, much more spacious than the former. The eye is first attracted by the end of this court, where six enormous and majestic columns render the scene astonishingly grand and picturesque. Another object not less interesting is a second range of columns to the left, which appear to have been part of the peristyle of a temple; but before we pass hither we cannot refuse particular attention to the edifices, which enclose this court on each side. They form a sort of gallery which contains various chambers, seven of which may be reckoned in each of the principal wings; viz. two in a semicircle, and five in an oblong square. The bottom of these apartments still retains pediments of niches and tabernacles, the supporters of which are destroyed. On the side of the court they are open, and present only four and six columns totally destroyed. It is not easy to conceive the use of these apartments; but this does not diminish our admiration at the beauty of their pilasters, and the richness of the frieze and of the entablature. Neither is it possible to avoid remarking the singular effect which results from the mixture of the garlands, the large foliage of the capitals, and the sculpture of wild plants with which they are every where ornamented. In traversing the length of the court, we find in the middle a little square esplanade, where was a pavilion, of which nothing remains but the foundation. At length we arrive at the foot of the six columns; and then first conceive all the boldness of their elevation, and the richness of their workmanship. Their shafts are 21 feet 8 inches in circumference, and 58 high; so that the total height, including the entablature, is from 71 to 72 feet. The sight of this superb ruin, thus solitary and unaccompanied, at first strikes us with astonishment; but on a more attentive examination, we discover a series of foundations, which mark an oblong square of 268 feet in length, and 146 wide; and which, it seems probable, was the peristyle of a grand temple, the primary purpose of this whole structure. It presented to the great court, that is to the east, a front of ten columns, with nineteen on each side, which with the other six make in all fifty-four. The ground on which it stood was an oblong square, on a level with this court, but narrower than it; so that there was only a terrace of 27 feet wide round the colonnade. The esplanade this produces fronts the open country toward the west, by a sloping wall of about 30 feet. This descent, as you approach the city, becomes less steep; so that the foundation of the pavilion is on a level with the termination of the hill, whence it is evident that the whole ground of the courts has been artificially raised.

"Such was the former state of this edifice; but the southern side of the grand temple was afterwards blocked up to build a smaller one, the peristyle and wall of which are still remaining. This temple, situated some feet lower than the other, presents a side of thirteen columns, by eight in front (in all thirty-four), which are likewise of the corinthian order; their shafts are 15 feet 8 inches in circumference, and 44 in height. The building they surround is an oblong square, the front of which, facing the east, is out of the line of the left wing of the great court. To reach it you must cross trunks of columns, heaps of stones, and a ruinous wall by which it is now hid. After surmounting these obstacles, you arrive at the gate, where you may survey the enclosure which was once the habitation of a god; but instead of the awful scene of a prostrate people, and sacrifices offered by a multitude of priests, the sky, which is open from the falling in of the roof, only lets in light to show a chaos of ruins covered with dust and weeds. The walls formerly enriched with all the ornaments of the corinthian order, now present nothing but pediments of niches, and tabernacles, of which almost all the supporters have fallen to the ground. Between these niches is a range of fluted pilasters, whose capitals support a broken entablature; but what remains of it display a rich frieze of foliage, resting on the heads of satyrs, horses, bulls, &c. Over this entablature was the ancient roof, which was 57 feet wide, and 110 in length. The walls which supported it are 31 feet high, and without a window. It is impossible to form any idea of the ornaments of this roof, except from the fragments lying on the ground; but it could not have been richer than the gallery of the peristyle: the principal remaining parts contain tablets in the form of lozenges, on which are represented Jupiter seated on his eagle: Leda caressed by the swan; Diana with her bow and crescent; and several busts, which seem to be figures of emperors and empresses."

Several changes, however, have taken place since their journey; for example, they found nine large columns standing; and in 1784, there were but six. They reckoned nine and twenty at the lesser temple, but there now remain but twenty; the others have been overthrown by the earthquake of 1759. It has likewise so shaken the stone walls of the smaller temple, that the stone of the soffit of the gate has slid between the two adjoining ones, and descended 8 inches; by which means the body of the bird, sculptured on that stone, is suspended, detached from its wings and the two garlands which hung from its beak and terminated in the two genii. Nature alone has not affected this devastation; the Turks have had their share in the destruction of these columns. Their motive is to procure the iron cramps, which serve to join the several blocks of which each column is composed. These cramps answer so well the end intended, that several of the columns are not even disjointed by the fall; one among others, as Mr. Wood observed, has penetrated a stone of the temple wall without giving way. Nothing can surpass the workmanship of these columns; they are joined without any cement, yet there is not room for the blade of a knife between their interstices. After so many ages, they in general retain their original whiteness. But what is still more astonishing, is the enormous stones which compose the sloping wall. To the west, the second layer is formed of stones which are from 28 to 35 feet long, by about 9 in height. Over this layer at the north-west angle, there are three stones which alone occupy a space of 175 feet and a half; viz. the first, 58 feet 7 inches; the second, 58 feet 11; and the third, 58; and each of these are 12 feet thick. These stones are of a white granite, with large shining flakes like gypse; there is a quarry of this kind of stone under the whole city, and in the adjacent mountain, which is open in several places, and, among others, on the right as we approach the city. There is still lying there a stone, hewn on three sides, which is 69 feet 2 inches long, 12 feet 10 inches broad, and 13 feet 3 inches in thickness.

The tradition which ascribes the buildings at Balbec, and also Palmyra, to Solomon, and on which the inhabitants of the country confidently rely, is founded on an opinion generally prevalent of his wisdom and love of pleasure, with both of which the magnificence, beauty, and disposition of these buildings perfectly agree; and on the mention of "Tadmor in the wilderness, and the tower of Lebanon, looking toward Damascus," which are said in the Old Testament to have been built by his direction.

Some have supposed that these are the ruins of a temple of the sun built by the Phœnicians, because it is certain that the sun was worshipped at this place when the Phœnicians were in their most flourishing state. Others have thought, that these buildings were erected by the Greeks, who succeeded the Phœnicians in this country, because they are of the corinthian and ionic order, but as they are not mentioned from the time of Alexander's conquest to that of Pompey, there is great reason to suppose they are of later date.

When we consider the extraordinary magnificence of the temple of Balbec, we cannot but be astonished at the silence of the Greek and Roman authors. Mr. Wood, who has carefully examined all the ancient writers, has found no mention of it, except in a fragment of "John of Antioch," surnamed Malala, who attributes the building of this edifice to Antoninus Pius. He says, that this Emperor "built a great temple to Jupiter at Heliopolis, near Libanus, in Phœnicia, which was one of the wonders of the world." This is the only historical authority that has yet been discovered relating to this subject. As these buildings seem to have been erected between the time of Pompey and Caracalla, it is very probable they were the work of Antoninus Pius. The inscriptions that remain corroborate this opinion, which perfectly accounts for the constant use of the corinthian order, since that order was not in general use before the third age of Rome; but we ought by no means to allege as an additional proof, the bird sculptured over the gate; for if his crooked beak, large claws, and the caduceus he bears, give him the appearance of an eagle, the tuft of feathers on his head, like that of certain pigeons, proves that he is not the Roman eagle: besides that, the same bird is found in the temple of Palmyra, and is, therefore, evidently an oriental eagle, consecrated to the sun, who was the divinity adored in both these temples. His worship existed at Balbec in the most remote antiquity. His statue, which resembled that of Osiris, had been brought thither from the Heliopolis of Egypt, and the ceremonies with which he was worshipped there, have been described by Macrobius in his curious work, entitled "Saturnalia." Mr Wood supposes, with reason, that the name of Balbec, which in Syriac signifies *city of Baal*, or of the sun, originated in this worship. The Greeks by naming it Heliopolis have, in this instance, only given a literal translation of the oriental words, a practice to which they have not always adhered.

We are ignorant of the state of this city in remote antiquity; but it is to be presumed, that its situation on the road from Tyre to Palmyra, gave it some part of the commerce of those opulent capitals.

Under the Romans, Heliopolis was constituted a colony by Julius Cæsar; and in the time of Augustus, it is mentioned as a garrison town, for it received part of the veterans of the fifth and eighth legions; and there is still remaining on the wall of the southern gate, to the right as we enter, an inscription which proves the truth of this, the words *Kenturia Prima*, in Greek characters, being very legible. One hundred and forty years after, Antoninus built there the present temple, in place of the ancient one, which, doubtless, was falling into ruins. Christianity, however, having gained the ascendancy under Constantine, the modern temple was neglected, and afterwards converted into a church, a wall of which, that hid the sanctuary of the idols, is still remaining. It continued thus until the invasion of the Arabs, when it is probable they envied the christians so beautiful a building. The church being less frequented, fell to decay; wars succeeded, and it was converted into a place of defence; battlements were built on the wall which surrounded it, on the pavilions, and at the angles, which still subsist; and from that time, the temple, exposed to the ravages of war, fell rapidly to ruin."

Mr. Wood's book, entitled *Les Ruines de Balbec*, contains forty-six folio plates, illustrative of the state of the ancient buildings in Balbec, at the time that he and Mr. Dawkins visited it in the year 1751. But as the limits of this work will not admit of our giving more than a small portion of these plates, we have endeavoured to select such as will be the most useful to our readers.

Plate B^2, *Balbec*, is a plan and elevation of the semicircular exedræ of the great temple.

A, niche; enlarged in plate B^3.

B, tabernacle above the niche; enlarged in plate B^5.

C, entablature; enlarged in plate B^5.

D, soffit of the arched roof.

Plate B^3, *Balbec*. Elevation of the niche in the semicircular exedra; and between the pilasters of the quadrangular court, with a part of the tabernacle above.

A, end of the niche.

B, pilaster of the niche, of the

composite order, ornamented with oak-leaves.

C, great pilaster of the court. See this order entire in plate B5.

D, frieze within the niche, of a size equal to the height of the capitals of the pilasters.

E, shell, which forms the upper part of the niche.

F, pedestal for a statue.

G, columns of the tabernacle above the niche.

Plate B4, *Balbec*. Plan and elevation of the tabernacle, above the niche,as shown in the last plate.

A, plan of the tabernacle.

B, C, its depth in the wall.

D, plan of the composite columns.

E, plan of the pilasters of the courts. Plate B5, will show the order.

Plate B5, a column and entablature of the two courts. The shaft of the column consists of a single block of granite, and the vase and capitals were of the same materials as the rest of the edifice.

The shafts of the columns of the great temple were composed of three pieces, very closely joined without the aid of cement, and fastened together by clamps of iron. For the reception of these bars of iron, holes were made in each of the stones. Most of the bases have two of these holes, the one circular, the other square, which correspond with two holes of the same form and dimensions in the inferior parts of the shafts. On measuring some of the largest of the circular holes, it appeared to Mr. Wood, that the rods of iron that had been inserted in them must have been a foot long, and more than a foot in diameter; the whole of the ruins which he saw had similar holes, hence he concluded that each of the stones had been secured in the manner above described. This diminished his surprise of the quantity of iron, which the inhabitants informed him had been taken from the ruins by the bashaws of Damascus; and the marks of their violent though vain, efforts to take the iron from the columns still standing were very evident.

Plate B6, elevation of the front of the most entire temple restored.

Plate B7, side elevation of the same temple.

Plate B8, order of the peristyle of the same temple. Most of the columns are composed of three, though some of them are only of two pieces.

Plate B9, column in the interior of the temple; the shaft of which is composed of several pieces.

Plate B10, view of the circular temple, in the state in which it was found by Mr. Wood. The outside of this temple was of the corinthian order, the inside of the corinthian and ionic: the shafts of the columns, both exterior and interior, are of a single piece.

Balcony. From the French *balcon*, a kind of open gallery, projecting from the walls of buildings, contrived chiefly for the convenience of looking around, seeing processions, cavalcades, and the like. When there is but one balcony to a house, it is usually placed on a level with, and extending the whole length of the first floor. Balconies are sometimes made of wood, and sometimes of cast-iron; they are also made of wrought-iron, fashioned into various fanciful figures; and sometimes of stone. A separate balcony is sometimes placed to each window; and are usually made convex to the street. Where balconies are placed, it is customary to extend the windows to the floor, or very near to it, without giving the aperture any additional breadth.

Balcony. *In Naval Architecture.* A gallery, either covered or open, made abaft, for convenience or ornament of the captain's cabin.

Baldachin, or baldaquin. This word is derived from the Italian *baldachino*, and implies a building in the form of a canopy, supported with columns, and serving as a crown or covering to an altar.

Balection mouldings. See *Belection Mouldings.*

Balks. Large pieces of timber brought from abroad in floats; or a sort of beams imported, from 5 to 12 inches square. The greater balks are accounted timber if above 8 inches square. Balk is also used in some parts of England for the summer-beam of a building, as also for the poles or rafters laid over outhouses or barns. It is used among bricklayers, for the pieces of timber used in making scaffolds.

Balloon. A round ball or globe placed at the top of a pillar, or the like, by way of acroter or crowning. That on the top of St. Peter's, at Rome, is of brass, sustained by an iron arming within; and being at the height of sixty-seven fathoms, is above 8 feet in diameter.

Balneum. A bath.

Balthei. A word used by Vitruvius for some part of the ionic volute, generally supposed to be the mouldings that encompassed the bolsters.

Baluster. A small kind of column, or pillar, belonging to a balustrade.

Baluster. The lateral part of the volute of the ionic capital, Vitruvius calls it *pulvinata*, on account of its resemblance to a pillow.

Balustrade. This word is derived from the Latin *balustrum*, or *balustrium*; a space in the ancient baths that was railed in. Balustrades are sometimes of real use in buildings, and at other times they are merely ornamental. Such as are intended for use, as when they are employed in stair-cases, before windows, to enclose terraces, &c. must always be nearly of the same height, never exceeding 3 feet and a half, nor ever less than 3 feet, so that a person of ordinary size may, with ease, lean over them, without being, at the same time, in danger of falling. But those that are principally designed for ornament, as when they finish a building, should be proportioned to the architecture they accompany. Palladio, in some of his works, has made the height of the balustrade equal to that of the whole entablature; and Inigo Jones, in many of his buildings, has followed his example, particularly at the banqueting-house, Whitehall, or, as it is now most generally called, Whitehall chapel. Sir William Chambers objects to this great height being given to the balustrade, and states that it should never exceed four-fifths, nor be less than two-thirds of the height of the entablature on which it is placed.

There are various figures of balusters; the most regular of which are delineated in plate B^{11}, *Balusters.* The handsomest are the three in the first row: the profiles and dimensions of which all differ. The simplest of them may serve to finish a tuscan order; and the others may be employed in the doric, ionic, corinthian, and composite orders, according to their degrees of richness. The best proportion for balustrades of this kind is, to divide the whole given height into thirteen equal parts; and to make the height of the baluster equal to eight, the height of the base to three, and that of the cornice or rail to two, of those parts; and if it be required to make the baluster less, to divide the height of the balustrade into fourteen parts, giving eight parts to the baluster, four to the base, and two to the rail. One of these parts may be called a module; and being divided into nine minutes, may serve to determine the dimensions of the particular members, as in plate B^{II}.

The other designs of balusters exhibited in the same plate, are likewise very perfect in their kinds, and are collected from the works of Palladio and other great masters. The double-bellied ones, being the highest, are most proper to accompany windows, or other compositions, whose parts are small, and whose profiles are delicate. The base and rail of these balusters may be of the same profile as the single-bellied; but they must not be quite so large. Two-ninths of the baluster will be a proper height for the rail, and three for the base. The proportions of the balusters may easily be found by reference to the plate, where the height of each is divided into such a number of parts as is most convenient for the distribution of the inferior divisions; one of which parts is the module divided into nine minutes.

In balustrades, the distance between two balusters should not exceed half the diameter of the baluster, measured in its thickest part; nor be less than one-third of it. The pedestals which support the rails should be kept at such a distance, that the balustrades have not a heavy look by their being too frequent, nor a weak appearance by their being too far asunder. The most eligible distance between them is, when room is left in each interval for eight or nine whole balusters, besides the two half ones engaged in the flanks of the pedestals. But as the disposition of the pedestals depends on the situation of the piers, pilasters, or columns, in the front, it being customary to place a pedestal directly over the middle of each of these, it frequently happens that the intervals are sufficient to contain sixteen or eighteen balusters. In this case, each range may be divided into two, by placing a die in the middle, flanked with two half balusters. The breadth of this die may be from one-half to two-thirds of the breadth of a pedestal; and it will be best to continue the rail and base in a straight line, without having a break round it: for frequent breaks of any kind are defective; and much more so when they are of different dimensions, because they then render the confusion greater.

The breadth of the pedestals, when they are placed on columns or pilasters is regulated by them; the die never being made broader than the top of the shaft, nor of much narrower dimensions. When there are neither columns nor pilasters in the front, the die should never be much lower, and seldom higher than a square.

On stairs, or any other inclined planes, the same proportions are to be observed as on horizontal ones. Sometimes it is customary to make the mouldings of the balusters follow the inclination of the plane; but this is difficult to execute, and not very handsome when done; consequently it is better to keep them horizontal, and to make the abacus and plinth in the form of wedges, making the height at the axis of the baluster the same as usual. See *fig.* D, plate B.[11]. The distance between two balusters on inclined planes, must not be so much as when they are on a horizontal situation; because the thickest parts do not then come on the same level. Le Clerc thinks it best to finish the inclined balustrades of stairs, or steps, with horizontal pedestals, placed on the floor or pavement to which they descend. The method of joining the horizontal mouldings of these to the inclined ones of the rail and base of the pedestal is shown in *fig.* D, plate B[11].

As the intention of balustrades is to enclose terraces, and other heights, where persons walk, with a view to prevent accidents, it is, as D'Avila observes, an impropriety to place them on the inclined cornices of pediments, as at Santa Susanna and Santa Maria della Vittoria, near Dioclesian's baths, at Rome; or in any other places where it is not apparently practicable for men to walk. When balustrades are used in interior decoration, as on stairs, or to enclose altars, thrones, tribunals, alcoves, &c.; or are used in gardens, to enclose basins of water, fountains, or any other decoration, the figures of the balusters may be varied and enriched with suitable ornaments.

If statues are to be placed on a balustrade, their height must not exceed one quarter of the column and entablature on which the balustrade stands. Their attitude must be upright, or, if any thing, bending a little forward; but must never incline to either side. Their legs must be close to each other, and the drapery close to their bodies; for when they stand straddling, with their bodies tortured into half a dozen bends, and their draperies waving in the wind, as on the colonnades of St. Peter's, they have a most disagreeable effect, especially at a distance, from whence they appear like lumps of unformed materials, ready to drop upon the heads of the passengers.

Band. A flat member, or moulding, smaller than the facia. The face of the band is in a vertical plane, as also is that of the facia: but the word band is applied to narrow members somewhat wider than fillets; and the word facia to broad members, as the facia of an architrave. The cincture round the shaft of a rusticated column is called the band.

Banded column. A column encircled with bands, or annular rustics.

Bandelet, bandlet, or band. Any little band, or flat moulding, that encompasses a column like a ring.

Banister. A vulgar term for baluster.

Banker. A stone bench on which masons cut and square their work.

Banquet. The foot-way of a bridge, raised above the carriage-way.

Banqueting-room. In the early ages of Rome, the inhabitants supped in the *atrium* or vestibule of their houses; but in after times, magnificent saloons, or banqueting-rooms, were built for the more commodious and splendid entertainment of their guests. Lucullus had several of these, each distinguished by the name of some god; and there was a particular rate of expense appropriated to each. Plutarch relates with what magnificence he entertained Cicero and Pompey, who went with the design to surprise him, by his telling the slave in waiting, that the cloth should be laid in the Apollo. The emperor Claudius, among others, had a splendid banqueting-room named Mercury; but every thing of the kind was outdone by the lustre of that celebrated banqueting-house of Nero, call *domus aurea*, the house of gold; which by the circular motion of its ceilings and partitions, imitated the revolutions of the heavenly bodies, and represented the different seasons of the year, which changed at every service, and showered down flowers, essences, and perfumes, on the guests. Heliogabalus, however, is said to have improved as much upon Nero, as the latter had done upon Lucullus.

Baptismal-font. The vessel which contains the water used in the administration of baptism.

Baptistry. An apartment or edifice where baptism is administered.

Bar. This word is used in courts of justice to denote an enclosure made with a strong partition of timber, 3 or 4 feet high, where the counsel are placed to plead causes. The same term is also given to the benches where the lawyers or advocates are seated; hence the lawyers who are licensed to plead are called barristers.

Bar. A piece of wood or iron used for fastening doors, window-shutters, &c.

Bars for the shutters of windows. See *Shutters*.

Bars of a boarded door. See *Ledges*.

Bars of a sash. Light pieces of wood or metal which divide the window-sash into several compartments for the admission of the several panes of glass. *Angle-bars* are those which stand in the intersection of two vertical planes.

Bar-iron. Iron-ore, when first dug from the pits, is found to consist of iron united with oxygen, and various proportions of earthy matter. The earthy matter when abounding in alumine, or clay, is called *argillaceous*; and when abounding in lime, *calcareous*. Iron-ore is first subjected to a process called *roasting*, in order to extract the arsenic and sulphur. This process consists in laying the iron-stone in strata, with refuse pit-coal, or, as it is called in Staffordshire, *slack*, and, setting fire to it on the windward side, burning it in large heaps in the open air. When it has been roasted, it is taken to the smelting or blast-furnace, the lower part of which is filled with either charcoal or coke: the coke is always a fixed quantity, and the proportion of limestone or clay added to the ore is according to the quantity of heterogeneous matter with which the metal is combined. If the ore abound with calcareous ingredients, clay is added as flux; but if it abound in argillaceous matter, the flux is limestone.

The materials in the furnace are, previously to the introduction of the blast, heated simply by the draught of the atmosphere; the coke and limestone to a bright red or white heat, and the iron-ore to a melting heat. The blast is then introduced, and the ore is soon brought into a state of fusion. It is then tapped, and run into moulds made in sand, and when cold is called pig-iron.

The pig-iron which has the smallest portion of carbon is the best adapted for conversion into malleable iron: and, as a proof that pig-iron has only to lose its carbon to become wrought or malleable iron we shall state the fact, that we have in this country, at this present time, many manufactories upon a large scale, for the express purpose of converting articles made of cast-iron, as nails, cutlery, &c. into iron perfectly malleable, without altering in the slightest degree the figure given to them in casting. We have even seen nails made in this way, welded together, and when cold bent at right angles in a vice.

The method of releasing the pig-iron of its carbon, or of converting it into what is called wrought or malleable iron, is by placing it in any open furnace, termed a refinery, and by some a run-out furnace, heated by coke, and subjected to the operation of a very powerful blast. The pig-iron is laid upon cakes, and is soon melted, leaving much of its impurity behind. This is termed refining it. The metal when melted is run into plates, about 4 inches thick, and as soon as it becomes set is thrown into water, which makes it more frangible and easier to be broken.

The cake of metal is then broken into lumps of a convenient size, and taken to the puddling-furnace where it is heated with coals, without the aid of an artificial blast. As soon as the metal becomes heated and begins to melt, or has a frosty appearance, the furnace-man throws in a small quantity of water to keep it at a proper temperature, and keeps stirring and moving it about, so that the carbon makes its escape. The water that is thrown in to preserve the temperature, also assists in some degree the decarbonization. The quality of iron depends much upon the attention that is paid to it during this process.

When the iron is deprived of the carbon, or fusible property that it before possessed, the furnace-man rolls it up into balls of one-half or three-quarters of a hundred-weight each. It is then brought out of the furnace and placed under a tilt-hammer, or passed through rollers, which consolidates it, and forces out more of the impure parts. A considerable loss in weight is sustained in this process, not only from the iron losing its impurities, but also from the surface of the bloom or bar oxydizing and falling off in scales whilst being worked. The loss which is thus sustained in weight is generally estimated at one-sixth, or one-seventh, of the whole.

Having undergone this process, the iron is taken to the shears, and cut into lengths of about 1 or 2 feet, and in order to impart closeness and solidity is piled into pieces of seven or eight together, and heated in another furnace. There is no occasion this time to remove the iron about, for, having lost its carbon, it is infusible. When it is of sufficient heat, which, from practice, the furnace-man can easily tell by his eye, it is again carried to either the hammer or rollers, and is worked into a bar; this is called *bar-iron*. Iron thus made is called No. 2; but being cut up, piled and worked over again, it is denominated No. 3, or best iron.

BAR-IRON.

Tables of the average weight of Bars, Squares, and Bolts, 10 feet in length.

BARS.

Inches.	Cwt.	qr.	lbs.	Inches.	Cwt.	qr.	lbs.	Inches.	Cwt.	qr.	lbs.
6 + ¾	1	1	15	3¾ + ¾	0	3	12	2¼ + ⅝	0	1	23
⅝	1	0	13	⅝	0	2	24	½	0	1	10
½	0	3	19	½	0	2	8	⅜	0	1	1
5½ + ¾	1	1	1	⅜	0	1	20	2⅛ + ¾	0	2	2
⅝	1	0	6	3½ + ¾	0	3	5	⅝	0	1	18
½	0	3	10	⅝	0	2	18	9/16	0	1	14
5 + ¾	1	0	13	½	0	2	4	½	0	1	9
⅝	0	3	23	⅜	0	1	16	⅜	0	1	0
½	0	3	2	3¼ + ¾	0	2	27	2 + ¾	0	1	24
4¾ + ¾	1	0	10	⅝	0	2	14	⅝	0	1	15
⅝	0	3	19	½	0	1	27	9/16	0	1	11
½	0	2	25	⅜	0	1	14	½	0	1	6
⅜	0	2	5	3 + ¾	0	2	22	⅜	0	0	26
4½ + ¾	1	0	4	⅝	0	2	8	1⅞ + ¾	0	1	20
⅝	0	3	13	½	0	1	23	⅝	9	1	12
½	0	2	21	⅜	0	1	10	9/16	0	1	9
⅜	0	2	11	2¾ + ¾	0	2	14	½	0	1	5
4¼ + ¾	0	3	25	⅝	0	2	2	⅜	0	0	24
⅝	0	3	7	½	0	1	20	1¾ + ¾	0	1	17
½	0	2	17	⅜	0	1	7	⅝	0	1	10
⅜	0	2	0	2½ + ¾	0	2	8	9/16	0	1	5
4 + ¾	0	3	19	⅝	0	1	25	½	0	1	2
⅝	0	3	1	½	0	1	15	⅜	0	0	23
½	0	2	12	⅜	0	1	4	1½ + ¾	0	1	11
⅜	0	1	24	2¼ + ¾	0	2	5	⅝	0	1	3
								9/16	0	1	0

SQUARES.

Inches	Cwt.	qr.	lbs.	Inches	Cwt.	qr.	lbs.
3	2	3	0	1⅝	0	3	2
2⅞	2	2	3	1½	0	2	21
2¾	2	1	8	1⅜	0	2	11
2⅝	2	0	11	1¼	0	1	25
2½	1	3	18	1⅛	0	1	15
2⅜	1	2	24	1	0	1	6
2¼	1	2	5	⅞	0	0	26
2⅛	1	1	14	¾	0	0	19
2	1	0	25	⅝	0	0	13
1⅞	1	0	8	½	0	0	8
1¾	0	3	21				

BOLTS.

Inches	Cwt.	qr.	lbs.	Inches	Cwt.	qr.	lbs.
3	2	0	18	1⅝	0	2	16
2⅞	1	3	22	1½	0	2	3
2¾	1	3	6	1⅜	0	1	24
2⅝	1	2	17	1¼	0	1	14
2½	1	1	23	1⅛	0	1	5
2⅜	1	1	11	1	0	0	27
2¼	1	0	24	⅞	0	0	20
2⅛	1	0	9	¾	0	0	15
2	0	3	24	⅝	0	0	10
1⅞	0	3	9	½	0	0	7
1¾	0	2	26				

Bar-posts. Posts driven into the ground to form the sides of a field-gate. These posts are mortised, to admit of horizontal bars being placed in, or taken out, at pleasure.

Barbacan. A long narrow canal, or opening, left in the walls of a building, erected on a place that is liable to be overflowed, to allow the water to flow through: also to drain off the water from a terrace, or the like.

Barbacan, or barbican. *In Ancient Fortification.* An outer defence, or fortification to a city, or castle; used especially as a fence to the gates or walls. In this sense, barbacan amounts to the same thing with what is otherwise called *ante-murale, pro-murale, murus exterior*, or *outer wall.* The same word also expresses a fort at the entrance of a bridge, or in the outlet of a city, having a double wall with towers; also an aperture in the wall of a city, through which muskets were pointed at the enemy. See *Embrasure.*

Barge-course. That part of the tiling which projects over the gable of a building, and is made up below with mortar.

Barkary. A tan-house, or house in which tanners keep their bark.

Barn. A covered building used by agriculturists, for laying up and preserving all sorts of grain, hay, straw, &c.

Barns should be erected on a dry and rather elevated situation; on the north or north-east side of the farm-yard; and the barns, outhouses, and stables, should be situate near to each other. Barns may be constructed on wooden frames with weather boarding, or built of stone and brick, and the roof may be thatched or tiled, according as either of these materials are the easiest to be procured. With the view of keeping the grain as dry as possible, and prevent it from moulding, the gable ends should be constructed of brick, and apertures should be left in the walls for the free admission of air. Two pair of folding doors, exactly opposite to each other, must also be made to the barn, for the convenience of carrying in and out a cart or waggon load of corn in sheaves, or any other sort of bulky produce. These doors should be of the same breadth as the threshing floor, to afford light to the threshers, and air for winnowing the grain. A barn has sometimes a large penthouse over the great doors, which is made to project sufficiently to cover a load of corn or hay, in case a sudden storm should come on before it can be housed; and also to shelter the poultry from the effects of the weather.

Hay-barns should always be constructed of wood, and not be placed too close to each other.

They are sometimes built on rollers, which admit of their being removed from one place to another.

It is observed in the sixteenth volume of the "Annals of Agriculture," in speaking of the construction of barns, that the under-pinning should be of brick or stone, 2 feet high above the ground, and the sides boarded; the roof of the barn is best covered with reed or straw, and those of the stables on its sides with slate or glazed tile; because they must be more flat, and the water which runs from the roof of the barn would injure most other coverings. At each end of the barn, and over the back door, small doors, 4 feet square, should be fixed at the height of 12 feet from the ground; the two former for putting corn in at the ends, and the latter for filling the middle of the barn after the bays are full. All the bays should have a floor of clay or marl, and the threshing floor be made with hard bricks, which will be sufficient for all sorts of grain except wheat and rye; and for threshing them, it will be good economy to have planks of oak or red deal well fitted together and numbered, to be laid down occasionally, and confined by a frame at their ends. A barn built on such a plan would hold a great deal of corn, and be filled most conveniently; and if the stacks of corn were built at each end, they might be taken in without any carting. If more buildings are requisite, two may be added on the back side, like the stables in front; otherwise if doors be made under the eaves on the back side, as directed at the ends, and stacks be placed opposite to them, just far enough to avoid the eaves dropping, by placing a waggon between them and the barn by way of a stage, these stacks may be taken in without carting; which method spares a great waste of corn and much trouble. The spars of the roofs of the stables rest upon the upper cills of the sides of the barn, and the outside wall of the stables is 8 feet high; the barn supplying the highest side and one end of each stable, and the stables in return are buttresses to the barn and strengthen it greatly.

It is remarked by the author of the "Agricultural Survey of the County of Somerset," that the practice lately introduced of placing barns on a declivity cannot be too much recommended; as a warm and commodious range of stalls for cattle, covered by the same roof, is by that means obtained. Besides, the barn floor, by being thus elevated, is rendered more durable, and less subject to vermin; the grain is kept more dry and sweet than on a ground floor, and cannot slip through it without discovery. The plan, indeed, is, in his opinion, almost unexceptionable. Barns when built in this way should have a southern aspect, the arches of the cattle stalls facing that way. In respect to the size of barns in Gloucestershire, 52 feet by 24 feet in the clear, and from 16 to 20 feet in height to the plate, is considered a good barn: these dimensions admitting of four bays of 10 feet each, with a floor in the middle.

The invention of threshing machines has, in some measure, varied the construction of barns, as where they are made use of, they should be contrived chiefly with a view to the distribution of the straw. The machines being built in the centre, with the grain stacks adjoining them, in such manner, that they may be supplied without the assistance of carts and horses. The barns in these cases need not be so large, but they should have granaries provided in them, which, probably, may be most conveniently placed over the floors. In most of the old barns, threshing machines may be erected without much inconvenience or trouble.

Barrel-drain. A drain of the form of a hollow cylinder.

Barycæ, or barycephalæ. From *βαρυς*, low, or flat, and *κεφαλη*, a head; the Greek name for the temple in Aræastyles.

Bas-relief. See *Basso-relievo.*

Basalt. A stratified rock, very useful in building, paving, &c. When calcined and pulverized, it forms an excellent substitute for puzzolana, in the composition of mortar; and has the property of hardening under water.

Base. *In Geometry.* The lowest part of a figure or body.

Base of a solid. The surface on which it rests.

Base of a column. That part which is between the shaft and the pedestal; or, if there be no pedestal, between the shaft and the zoele, or plinth.

Each column has its particular base. The tuscan base is the most simple, having only a torus and a plinth. The doric base has an astragal more than the tuscan; but this was introduced by the moderns, as the ancients gave no base to the doric order. In the ionic base there is, according to Vitruvius, a torus and fillet, resting upon two scotias, divided by astragals and fillets; but both ancient and modern architects have, with very few exceptions, given to this order the attic base. The attic base consists of two toruses, or tori, and a scotia, and is applicable to every order except the tuscan. The corinthian base has two toruses, two scotias, and two astragals. And the composite base has one astragal less than the corinthian; but in this order, the ionic and corinthian bases are used indifferently. See *Attic, or Atticurgic Base,* and plate B[1], *Bases.*

When a column and its base are required to be of wood, it is best to make the base of several distinct pieces, joined together by glue, so that the grain of the wood may be in a horizontal, instead of a vertical, direction. The best mode of forming bases of this kind is as follows: let several pieces of wood, of equal length, be closely jointed together upon a perfectly flat surface, or board, so that the diameter of these several pieces when united make somewhat more than the intended diameter of the base of the column; let them be firmly united by glue, and, when dry, let the upper surface be planed smooth, in a line exactly parallel with the flat surface of the board on which they rest. Upon this course let a second course of the same number of pieces be placed, taking care that the centres of the several pieces, of which this second course is composed, rest exactly on the division line of every two pieces of the course below; and let them be glued together, and to the upper surface of the said course below. When the glue of this second course is dry, its surface may be planed similarly to the first, and a third course, in like manner, may be added. The horizontal joints of these courses must be so regulated as to fall at the junction of two mouldings, forming an interior, or a re-entering angle. When the glue is become thoroughly hard, the base may be sent to be turned.

Base of a room. The lower projecting part of a room, consisting of a plain board, which adjoins the floor, called the plinth, and one or two mouldings above it, called the base-mouldings. In the best work, the plinth is tongued into a groove in the floor, with a view to prevent any crevice appearing between the bottom of the plinth and the surface of the floor, which, in works where this precaution has not been taken, is frequently the case, from the shrinkage of the wood. The upper part of the plinth is rebated upon the base. In rooms with pavement floors, the plinth of the base is generally of stone, and the mouldings are of wood, which is not so liable to be injured as stone mouldings. Bed-rooms, passages, lobbies, stair-cases, and sometimes vestibules and halls are finished without the dado and surbase.

Basement. The lower part or story of a building, on which an order is placed, with a base or plinth, die, and cornice.

The height of the basement varies in modern buildings, according as it is the cellar or ground story; and when it is the ground story, according to the nature or destination of the rooms on that floor. In Italy, where the summer apartments are frequently on the ground floor, the basements are sometimes very high. At the palace of the Porti, in Vicenza, the height of the basement is equal to that of the order; and at the Thieni, in the same city, its height exceeds two-thirds of that of the order, which, nevertheless, is almost of a sufficient size to comprehend two stories: but at the Villa Capra, and at the Loco Arsieri, both near Vicenza, the basement is only half the height of the order; because the ground floor consists of nothing but offices. These four examples are from the works of the great Palladio, and sufficiently authorize any variations that it may be necessary to make in basements. It will not, however, be advisable ever to make the basement higher than the order it supports; for the order being the richest part in the composition, and indicating the principal part in the fabric, ought to be predominant: nor ought it to be lower than half the height of the order, as otherwise the rooms will be low, and the windows ill-proportioned. But if the only use of the basement be to raise the ground floor, it need not be above 3, 4, or at most 5, feet high.

If the cellar story be the basement, and the height does not exceed 5 or 6 feet, it may be made quite plain, or with rustics, or formed into a continued pedestal; but when it is on the ground floor, it is usual to decorate it with rustics, supported on a base, and supported with a crowning string course. The rustics best appropriated to buildings where neatness and finishing are aimed at, are such as have a smooth surface. Their height including the joint, should never be less than one module of the order placed upon the building, nor much more. They are made either of a rectangular or triangular section, by imagining one of the sides of these sections to be a line extending across the front of the joints: and these joints may be either square or chamfered. The square joints should not be broader than one-eighth of the height of the rustic, nor narrower than one-tenth; and their depth must be equal to their breadth. Those that are chamfered must form a rectangle; and the breadth of the whole joint may be from one-fourth to one-third of the height of the flat surface of the rustic. Sometimes the vertical joints are omitted; but this has a very bad effect, and gives the building more the appearance of being constructed of planks of wood, than of stones. Palladio, in imitation of the ancients, always marked both the vertical and the horizontal joints. When the former of these are regularly and artfully disposed, the rustic work hath a very beautiful appearance.

The basement when high is sometimes finished with a cornice; but the usual method is only to crown it with a plat-band, whose height should not exceed the height of a rustic with its joints, nor ever be lower than the rustic, exclusive of the joint. The zocle, or plinth, at the foot of the basement, may be of the same height with the plat-band, or a trifle higher; and when there are arches, the plat-band, which supplies the place of the impost, must be of the height of a rustic, exclusive of the joint.

Basil. A word used by carpenters and joiners, to denote the angle to which the edge of an iron tool is ground. To work on soft wood, they usually make the basil twelve degrees: for hard wood, eighteen degrees: it being observed that the more acute or thin the basil is, the better and smoother it cuts; and the more obtuse, the stronger and fitter it is for service.

Basilic, or basilica. Denotes in ancient architecture a kind of public hall, or court of judicature, where the princes or magistrates sat to administer justice. The basilica consisted of a great hall, with aisles, porticoes, tribunes, and tribunals. With us, Westminster-hall is properly a basilica; but architects generally apply this word to any spacious building, as a hall or church. When applied to a church, it conveys an idea of great magnificence.

Among the Romans, the basilica was a large hall adjoined to the forum, and is thus described by Vitruvius: "The basilica should be adjoined to the forum on the warmest side, that the negociants may confer together, without being incommoded by the weather. The breadth is not made less than the third, nor more than the half of the length, unless the nature of the place opposes the proportions and obliges the symmetry to be different. But if the basilica have too much length, *chalcidicæ* (supposed to be some kind of apartments separated by a partition at the ends of the basilica,) as is the case in the basilica of Julia Aquilina. The columns of the basilica are made as high as the posticus is broad. The posticus is the third part of the space in the middle. The upper columns are less than the lower, as above written. The pluteumca podium, or continued pedestal) which is between the upper columns, should also be made a fourth part less than the same columns, that those who walk in the floor above may not be seen by the negociators below." The *epistylium*, zophorus, and coronæ, are proportioned to the columns as explained in the third book of the architecture of Vitruvius.

"Nor will basilicas of the kind of that at the colony of Julia of Fanum, which I designed and conducted, have less dignity and beauty; the proportions and symmetry of which are as follows. The middle *testudo* (the middle part or nave) between the columns is 120 feet long, and 60 feet broad. The posticus around the testudo, between the walls and columns, is 20 feet broad. The height of the continued columns, including their capitals, is 50 feet, and the thickness 5, having behind them parastatæ (attached pilasters) 20 feet high, 2 feet and a half broad, and 1 foot and a half thick, which sustain the beams that support the floors of the porticoes. Above these are other parastatæ, 18 feet high, 2 feet broad, and 1 foot thick, which also receive beams sustaining the canthers of the porticoes, which are laid below the roof of the testudo. The remaining space left between the beams that lay over the parastatæ, and those which lay over the columns, is left open in the intercolumns, in order to give light. The columns in the breadth of the testudo, including those of the angles to the right and left, are four; and in the length, on that side which is next the forum, including the same angle columns, eight. On the other side there are but six columns, including those of the angles, because the middle two on this side are omitted, that they may not obstruct the view of the pronaos of the temple of Augustus, which is situate in the middle of the side wall of the basilica, looking towards the centre of the forum and temple of Jupiter. The tribunal in this building is formed in the figure of a hemicycle; the extent of this hemicycle in front is 46 feet, and the recess of the curvature inward 15 feet, so that those who attend the magistrates obstruct not the negociants in the basilica.

"Upon the columns, the compacted beams, made from three timbers of 2 feet, are placed around; and these, from the third columns, which are the interior part, are returned to the antæ that procur from the pronaos, and on the right and left touch the hemicycle.

"Upon the beams, perpendicularly to the capitals, the pilæ (a kind of blocking for supporting the plates) are placed, 3 feet high and 4 feet broad, on every side. Over these other beams, well-wrought from timbers of 2 feet, are placed around; upon which the transtræ and capreols, (the principal rafters and braces,) being placed coincident with the zophorus, antæ, and walls of the pronaos, sustain one culmen (the horizontal piece of timber in the ridge of the roof) the whole length of the basilica, and another transversely from the middle over the pronaos of the temple: so that it causes a double disposition of the fastigium (the triangle, or pediment of the roof), and gives a handsome appearance to the roof on the outside, and to the lofty testudo within. The omission of the ornaments of the epistylium, and of the upper columns and plutei, diminishes the labour of the work, and saves great part of the expense. The columns likewise being carried in one continued height up to the beams of the testudo, increases the magnificence and dignity of the work."

From the preceding descriptions it should appear, that the ancient basilicas consisted of a great nave in the middle, surrounded with only one range of porticoes; and it is thus that it has been represented in the designs of all who have restored it from the words of Vitruvius.

"It is not probable," says the author of this article in Dr. Rees's "Cylopædia," "that the ancient basilicas were ever converted into christian churches; as in that case, we should still be in possession of some of these monuments of antiquity. The most ancient basilicas of the christians, those which date from the first centuries of the public exercise of our religion, were built expressly for their use; and the details of their architecture, announce but too clearly the time of their construction. But these new temples resembled so much the antique basilicas, that they retained their name; and indeed if we examine the buildings of antiquity, we shall find no other so well calculated for the purposes of our religion. These edifices, at once simple in plan and magnificent in decoration, were of form and disposition the most advantageous that can be imagined for large halls, and their construction combined solidity with economy.

Their solidity is proved by the duration of fourteen centuries of some of their buildings; and their economy consists in the lightness of the points of support, and in that of the covering which was only of carpentry. In most of the basilicas, the walls and points of support only occupy one-tenth of the total space; which, in buildings vaulted and supported with arcades, like many modern churches, take up at least twice that superficies, and require besides materials and modes of construction which quadruple the expense.

"It is to Constantine that the first christian churches known by the name of basilicas may be referred. This prince signalized his zeal by the erection of monuments which announced the triumph of the religion which he had embraced. He gave his own palace on the Cœlian mount to construct on its site a church which is recognised for the most ancient christian basilica. A modern building has so much marked and disfigured the ancient, that only the situation and plan of this monument can be discovered.

"Soon after, he erected the basilica of St. Peter of the Vatican. This magnificent edifice was constructed about the year 324, upon the site of the circus of Nero, and the temples of Apollo and Mars, which were destroyed for that purpose. It was divided internally into five aisles from east to west, which terminated at the end in another aisle from north to south, in the centre of which was a large niche or tribunal, giving the whole the form of a cross. The largest aisle was enclosed by forty-eight columns of precious marble and the lateral aisles had forty-eight columns of smaller dimensions; two columns were placed in each wing of the terminating aisle. The whole was covered with a flat ceiling, composed of immense beams which were cased with gilt metal, and corinthian brass taken from the temples of Romulus and Jupiter Capitolinus. A hundred smaller columns ornamented the shrines and chapels. The walls were covered with paintings of religious subjects, and the tribunal was enriched with elaborate mosaics. An incredible number of lamps illuminated this temple; in the greater solemnities two thousand four hundred were reckoned, of which one enormous candelabrum contained one thousand three hundred and sixty. The tombs of pontiffs, kings, cardinals, and princes, were reared against the walls, or insulated in the ample porticoes.

"This superb temple was respected by Alaric and Totila, and remained uninjured in the various fortunes of Rome, during the lapse of twelve centuries; but crumbling with age, it was at last pulled down by Julius II. and upon its site has arisen the famous basilica the pride of modern Rome.

"The third great basilica built by Constantine, that of St. Paul, on the road to Ostia, still exists. The interior of this building resembles precisely that of St. Peter which has just been described. Of the forty columns enclosing the great aisle, twenty-four are supposed to have been taken from the mausoleum of Adrian; they are corinthian, about 3 feet in diameter, fluted . their whole length, and cabled to one-third; the columns are of blue and white marble, and antiquity presents nothing in this kind more precious for the materials and workmanship. But these beautiful remains seem only to be placed there to the disgrace of the rest of the construction, which is of the age of Constantine and Theodosius, and which most strikingly exemplifies the rapid decline of the arts.

"The churches we have hitherto described bear a complete resemblance to the antique basilica in plan and proportion. The only remarkable difference is, that the superior galleries are suppressed, in the place of which a wall is raised upon the columns of the great aisle, which is pierced with windows, and supports the roof.

"The church of St. Agnese out of the walls, though not one of the seven churches of Rome, which retain the title, is however a perfect imitation of the antique basilica. This resemblance is so complete, that without the testimony of writers who tell us it was built by Constantine, at the request of Constantia his sister or daughter, and without the details of its architecture which forbid us to date it higher, it might be taken rather for an ancient tribunal of justice than a modern church. It forms an oblong internally, three sides of which are surrounded with columns forming the porticoes; the fourth side opposite the entrance is recessed in a semicircle; this is the tribunal. The first order of columns carries a second, forming an upper gallery, above which begins the ceiling of the edifice. The shortning of the columns, recommended by Vitruvius, is observed in the upper order.

"We have hitherto observed in the christian basilicas but small variations from the antique construction: they were still simple quadrilateral halls divided into three or five aisles, the numerous columns of which support the flat ceiling; but the cross form, the emblem of christianity, which began to be adopted in these buildings, operated the most essential changes in their shape. The intersection of the crossing aisles produced a centre, which it was natural to enlarge and make principal in the composition; and the invention of domes supported on pendentives enabled the architects to give size and dignity to the centre, without interrupting the vista of the aisles. The church of St. Sophia at Constantinople was the first example of this form.

"The seat of the Roman Empire being transferred to Constantinople, it is natural to suppose that the disposition of the ancient St. Peter's of Rome, esteemed at that time the most magnificent church in the world, was imitated in that which Constantine erected for his new capital under the name of St. Sophia. This last did not exist long: Constantius the son of Constantine, raised a new one which experienced many disasters. Destroyed in part, and rebuilt under the reign of Arcadius, it was burnt under Honorius, and reestablished by Theodosius the younger; but a furious sedition having arisen under Justinian, it was reduced to ashes. This emperor having appeased the tumult, and wishing to immortalize his name by the edifice he was about to erect, assembled from various parts the most famous architects, Anthemius, of Tralles, and Isidore, of Miletus, were chosen; and as they had the boldness to attempt a novel construction, they experienced many difficulties and disasters: but at last they had the glory of finishing their design.

"The plan of this basilica is a square of about 250 feet. The interior forms a Greek cross, that is, a cross with equal arms; the aisles are terminated at two ends by semicircles, and at the other two by square recesses, in which are placed two ranges of tribunals. The aisles are vaulted, and the centre, where they intersect, forms a large square, upon which is raised the dome, of about 110 feet diameter. The dome, therefore, is supported upon the four arches of the naves, and the pendentives or spandrels which connect the square plan of the centre with the circle of the dome.

"The general effect of the interior is grand; but whatever praises the bold invention of this immense dome may merit, it must be confessed that there are times in which princes, however great and liberal, can only produce imperfect monuments, of which this edifice is a striking example. All the details of its architecture are defective and barbarous.

"However, from the communication established between Greece and Italy at the revival of letters, this basilica, the last, as well as the most magnificent of the lower empire, was that which influenced most the form and architecture of the new temples. The Venetians, in the tenth century, copied with success the best parts of the disposition of St. Sophia in the church of St. Mark. This is the first in Italy which was constructed with a dome supported on pendentives; and it is also this which gave the first idea, which has been imitated in St. Peter's, of the Vatican, of accompanying the great dome of a church with smaller and lower domes, to give it a pyramidal effect."

From this time to the erection of the basilica of St. Peter's, we find the churches approach, more or less, to the form of the ancient basilica, or the new construction. The church of Santa Maria del Fiore of Florence, from the magnitude of its dome, and the skill which Brunelleschi displayed in its construction, acquired a celebrity which made the system of domes prevail; and this system was finally established in the noble basilica of the Vatican, which has become the type and example of later ones. The form of the antique basilica was entirely lost, and the name, which has been retained, is the only remains of their ancient resemblance.

"In the pontificate of Julius II. the beginning of the sixteenth century, the basilica of St. Peter's was begun from the designs of Bramante. This great man formed the idea of suspending in the centre of the building a circular temple, as large as the Pantheon, or, as he expressed it, to raise the Pantheon on the temple of Peace; and, in fact, we find great resemblance in size and disposition between these two edifices and the design of Bramante. He was succeeded in his office by San Gallo, who almost entirely lost sight of the original plan; but Michael Angelo, to whom at his death the undertaking was committed, concentered the discordant parts, and contracted the whole into the form of a Greek cross. Michael Angelo died in 1563, while he was engaged in erecting the dome; but he left plans and models, which were strictly adhered to by his successors, Vignola, J del Porte, and Fontana, who terminated the dome. The building was carried on under many succeeding pontiffs; and at last, by lengthening the longitudinal naves, it acquired the form of a lantern cross; in that particular, approaching to the original design of Bramante.

"The general form of this edifice externally is an oblong, with circular projections in three of the sides; the plan of the interior consists of a Latin cross; the intersection of the arcus of which is enlarged and formed into an octagon; the head of the long aisles, and the ends of the cross aisles are terminated in hemicycles, and the great naves are accompanied with lateral aisles, and with several enclosed chapels. The octagon centre supports a circular wall, enriched with pilasters, and pierced with windows, above which rises the magnificent dome.

"Thus we have traced the progress of the basilica from the quadrilateral hall of the ancients, with its single roof and flat ceiling supported on ranges of columns, to the cross-shaped plan, central dome, and vaulted aisles, supported on piers of the modern cathedral. It only remains to treat of the modern basilica.

"*Modern basilica.* We give this name with Palladio to the civil edifices which are found in many Italian cities, and the destination of which is entirely similar to the antique basilica.

"In imitation of the ancients," says this celebrated architect, "the cities of Italy construct public halls, which may be rightly called basilicas, as they form part of the habitation of the supreme magistrate, and in them the judges administer justice. The basilicas of our time (he continues) differ in this from the ancients; that those were level with the ground, while ours are raised upon arches, in which are shops for various arts, and the merchandize of the city. There are prisons also placed, and other buildings belonging to public business. Another difference is that the modern basilicas have their porticoes on the outside, while in the ancient they were only in the interior. Of these halls there is a very noble one at Padua, and another at Brescia, remarkable for its size and ornaments.

"But the most celebrated is that of Vicenza; the exterior part of which was built by Palladio, and the whole so much altered that it may pass for his work. The body of the building is of much greater antiquity, though the date of it is unknown.

"Time and various accidents had reduced this building to such a state of decay, that it was necessary to think seriously of preventing its total ruin; for this purpose the most eminent architects were consulted, and the design of Palladio was approved. He removed the ancient loggias, and substituted new porticoes of very beautiful invention. These form two galleries in height, the lower order of which is ornamented with doric engaged columns, at very wide intervals, to answer to the internal pillars of the old building; the space between each column is occupied by an arch resting on two small columns of the same order, and a pilaster at each side against the large columns, which leaves a space between it and the small columns of two diameters. The upper portico of ionic columns is disposed in the same manner, and a balustrade is placed in the archways. The entablature of the large orders is profiled over each column.

"This edifice is about 150 feet long, and 60 feet broad; the hall is raised above the ground 26 feet; it is formed by vaults supported on pillars, and the whole is covered with a wooden dome."

Basis. See *Base.*

Basin. A small reservatory of

water, as the basin of a jet d'eau, or fountain; the basin of a port, of a bath, &c. which last Vitruvius calls *labrum*.

Basins are made either with clay, cement, or lead; but they are most usually made with clay. In the making of them this way, the diameter must be made 4 feet longer on each side than the basin is to be. This will be taken up by the walls of clay. For the same reason, it must be dug 2 feet deeper than the intended depth of the water; because it is to be laid over 18 inches thick with clay, and 6 inches with gravel and paving. The wall is to be made with shards, rubbish, or flints, with the natural earth for mortar; and the clay must be well worked, and trod firmly down with the naked feet.

The way of making them with cement is, to allow 1 foot 9 inches every way for the work; then cut the banks perpendicularly, and raise a wall of masonry a foot thick, made of pebble stones, or the like, laid in mortar of lime and sand. The bottom is then to be covered to the same thickness; and the solid lining of the cement is to be backed up against the walls, and over the bottom. This is to be made of small flints in beds of mortar made of lime and cement. When this solid is 8 inches thick, it must be plastered over the whole surface with cement well sifted, before it be mixed with the lime; with this it is to be wrought over smooth with a trowel. The proportion of this cement should be two-thirds of the cement, or powdered tile, to one-third of lime. This cement has the property of becoming hard under water, like stone or marble, and it will not be subject to decay for a long time. After the finishing, the basin should, for four or five days, be anointed over very often with oil or bullocks' blood to keep it from cracking in the drying; and after this the water may be let in.

In selecting the materials, the builder should make choice of the best stone lime, such as that of Dorking, Bristol, or Dudley Castle, &c.; and the clay should be well mixed and kneaded before it be used. Parker's cement may also be very beneficially employed in the lining of basins, tanks, reservoirs, &c.

The leaded basins are made with walls a foot thick, and with a bottom of half that thickness. These walls should be of rubble stones, cemented with plaster; for lime would injure and eat the lead. The sheets of lead are to be spread over these walls and bottom, and seamed with solder. Leaded basins are now but seldom used; partly from the expense of making them, and partly from the danger of the lead being stolen.

The waste pipes of fountains should always be made of sufficient diameter for the water to pass off freely. When the waste water is to pass off into common sewers, or drains, earthen pipes will answer the purpose; but when it is to pass into basins that lie below it, it should be conveyed through leaden pipes.

There are divers sorts of basins; as

Basin *figured*. That whose plan or circumference makes several turns and returns, either straight, circular, or the like. Such are most of the basins and fountains at Rome.

Basin *with a balustrade*. That whose cavity is surrounded with a balustrade of brass, stone, or marble, &c.

Basin *with a trench*, or *basin à rigole*. That which hath a border of marble, or other stone, with a trench cut in it, from whence, at certain distances, springs out a thread of water, which lines the trench, and forms a kind of nape or gargle around the balustrade. Such is that of the fountain of the rock of the Belvidere at Rome.

Basin *en Coquille*. That shaped like a shell.

Basin is likewise used for a dock.

Basket. A kind of vase, in the form of a basket filled with flowers or fruits, serving to terminate some decoration.

Basse-cour. A court separated from the principal one, and destined for the stables, coach-houses, and livery servants. In a country-seat, it is the yard, or place, where the cattle, fowls, &c. are kept.

Basso-relievo, or bas-relief. The representation of figures, projecting from a back ground, without being detached from it. Though this word, in general language, implies all kinds of relievos, scientific men have divided the relievos into three classes, namely: *alto-relievo*, that in which the figure projects more than one-half from the back ground; *mezzo-relievo*, that in which the figure projects one-half; and *basso-relievo*, that in which the projection of the figure is less than one-half, as in coins. Some very beautiful specimens of relievo, the works of Phidias, are to be seen in the British Museum. Vide *Athenian Architecture.*

Bastile. A small antique castle fortified with turrets.

Bastion, or batoon. See *Torus.*

Bat. A part of a brick.

Bath. A receptacle of water, appropriated for the purpose of bathing.

Batten. A scantling of stuff from 2 to 6 inches broad, and from five-eights to 2 inches thick, used in the boarding of floors; also upon walls, in order to secure the lath on which the plaster is laid.

Battening. The act of fixing battens to a wall, with a view to secure the laths on which plaster is to be laid, or canvass fastened for papering. To prepare a wall for battening, the height of the room must be divided into equidistant parts, of from about 2 feet 6 inches to 3 feet, at which places bond timbers or plugs must be placed. On these bond timbers or plugs, the battens are fastened in a vertical direction. The distance from one plug to another in the horizontal course, or from one batten to another, is from 12 to 14 inches. The battens employed are commonly about an inch and a quarter thick, and 2 inches and a half, or 3 inches wide. The plugs on which the battens are fixed, are generally made flush with the wall; but in some cases, such as where the walls are damp, from the mortar being composed of sea-sand, it is necessary for the plugs to project an inch, that the damps may not affect either the plastering or papering.

Batter. When a wall is built in a direction that is not perpendicular to its base, it is said to batter. Walls are made to batter, in order to resist the weight of a body of water, mound of earth or any other pressure, that may rest against it. It must not, however, be understood that both sides of the wall are made to batter: that side on which the pressure is immediately acting, is made perpendicular above the footing; and it is the opposite side only that is made to batter. The exact batter that a wall should have must depend on local circumstances; and the architect in planning it should well consider the weight it has to resist.

Battlements. Indentations on the top of a parapet or wall, first used in ancient fortifications: and afterwards applied to churches and other buildings for ornament.

Batten door. See *Door*.

Batten floor. See *Boarded Floor*.

Battifolium, or battifollum. A kind of tower or defence, frequently mentioned by Latin historians of the middle age. It seems to have been of wood, and to have been erected on sudden and hasty occasions.

Baufrey. An old word for beam.

Baulk. A piece of timber from 4 to 10 inches square.

Baulk-roofing. This word is applied to roofing, when the framing is constructed of baulk timber.

Bay. Any kind of opening in a building, as a door, window, or chimney.

Bay of joists. The joisting between two binding joists, or between two girders, when there are no binding joists.

Bay of roofing. The small rafters and purlins between principal rafters.

Bay window. See *Bow Window*.

Bazar. A kind of mart, or exchange, for the sale of divers articles of merchandize. The word seems to be of Arabic origin, and in that language implies sale or exchange of goods.

Some of the eastern bazars are open, like the market-places in Europe, and serve for the same uses, more particularly for the sale of more bulky and less valuable commodities. Others are covered with lofty ceilings, or even domes, which are pierced to give light: and it is in these that the jewellers, goldsmiths, and other dealers in rich wares, have their shops.

The bazar, or *maidan*, of Ispahan is one of the finest places in all Persia, and even surpasses all the exchanges in Europe: yet, notwithstanding its magnificence, it is excelled by the bazar of Tauris, which is the largest that is known, having several times held thirty thousand men, arranged in order of battle.

At Constantinople there are two bazars, which are large square buildings, covered with domes, and sustained by arches and pilasters: one is appropriated for the sale of arms, harness, and the like; in the other, the goldsmiths, jewellers, furriers, and all sorts of manufacturers, have their shops.

Bead. A moulding of a circular section, frequently set on the edge of each fascia of an architrave, also used as the mouldings of doors, shutters, skirtings, imposts and cornices. When the bead is flush with the surface, it is called *quirk-bead;* and when raised, *cock-bead.*

Bead and butt work. A piece of framing in which the panels are flush, having beads stuck or run upon the two edges, having the grain of wood in their direction.

Bead butt and square work. Framing with bead and butt on one side, and square on the other, used chiefly in doors. The framing of bead, butt, and square work is put together square, and the bead is stuck on the edges of the rising sides of the panel.

Bead and flush work. A piece of framed work, with beads run on each edge of the included panel.

Bead, flush, and square work. Framing with bead and flush on one side, and square on the other, used chiefly in doors.

Bead and quirk. A bead stuck on the edge of a piece of stuff, flush with its surface, with only one quirk, or without being returned on the other surface.

Bead and double quirk. See *Return Bead.*

Beak. A small fillet left on the edge of a larmier, which forms a canal, and makes a kind of pendant chin, answering to what Vitruvius calls the *mentum*. The beak is sometimes formed by a channel or groove, recessed on the soffit of the larmier upwards: and is used to prevent the water from running down the lower bed of the cornice.

Beam. A piece of timber or metal of a rectangular section, used in buildings for sustaining a weight, or resisting some strain, either in a longitudinal or transverse direction. The word *beam*, however, is but seldom technically used, unless it be subjoined to, or compounded with, another word, used adjectively, as tie-beam, collar-beam, camber-beam, &c. &c. when it is in frequent use. See *Building of Beams, Scarfing, and Truss Beams.*

Beam compasses. See *Mathematical Instruments.*

Beam-filling. The building of masonry, or brickwork, from the level of the under edges to that of the upper edges of beams: also the filling up of the space from the top of the wall plate between the rafters, to the under side of the slating board, or other covering.

Bearer. Any thing which supports a body in its place, as a wall, post, strut, &c. Bearers, in guttering, are the short pieces of timber which support the boarding.

Bearing of a piece of timber. That part of a piece of timber which is unsupported, or is between two or more props or supports. For example, a piece of timber extending over two rooms is supported at each of its extremities by a wall, and in or near the centre, accordingly as the rooms be of equal or unequal breadth, by a partition; those parts of the piece of timber, therefore, which are unsupported, and which are of course equal to the breadth of the respective rooms, are called the bearers.

Bearing. The ends of a piece of timber inserted into walls, piers, &c.

Bearing wall, or partition. A wall which is built upon the solid, and is made to support another wall or partition, either in the same, or in a transverse, direction. When the supported wall is built in the same direction as the wall which supports it, it is said to have a solid bearing; but when it is built in a transverse direction, or not supported throughout its length, it is said to have a false bearing; or as many false bearings as there are intervals below the wall or partition.

Beater. An implement used by plasterers for tempering, or incorporating lime, sand, and hair together, to make the composition called lime and hair.

Beaufet, buffet, or bufet. A small cupboard, or cabinet, to contain china ware, &c. Formerly buffets were much ornamented, and were left open, or had glass doors to them; but now doors are made to conceal the articles that are inside from the eye of the spectator.

Bed-chamber, or bed-room. A room in which a bed is placed. In bed-rooms, the finishing of the joinery and plaster work is not so good as those of the drawing-rooms, parlours, &c.; and the bed-rooms of good houses are frequently finished without the surbase.

Beds of a stone. The horizontal courses of a wall of masonry; that at the under surface of any particular stone is called the *under-bed;* and that of the upper surface, the upper bed. The beds of a stone, in general language, are where two stones meet, without any regard to their direction.

The bed of every stone should be worked quite straight, and not dished or hollowed out, which masons are but too apt to do, with the view of making a fine joint. This practice cannot be too severely deprecated, as stones which have been thus worked, or dished out, are liable to flush or break off at the angles. Several instances of this kind have occurred at Blackfriars-bridge.

Bed of a slate. The under side of a slate, or that part which is placed in contiguity with the boarding or rafters.

Bedding of a templet. See *Templet.*

Beetle. A large mallet, used for the cleaving of wood, and driving of piles. Large beetles have two handles inserted about thirty degrees apart, to admit of their being lifted by two men.

Belection mouldings. Mouldings which project around the panels of a framing. Belection mouldings are never stuck on; and are now but seldom used, except in external decoration, and in the finishings of very grand houses.

Belfry. That part of a steeple in which the bells are hung. It is sometimes called by writers in the middle ages, *campanile.*

Bell of the Corinthian and composite orders. Is used to denote the body of the capital, by reason of its resemblance to the figure of a bell inverted. In this sense, bell is the same with what we otherwise call *vase* and *tambour;* sometimes also *corbeil.*

Bell-roof. A roof shaped somewhat similarly to a bell; its vertical section, perpendicular to the wall, being a curve of contrary flexure, convex at the top, and concave at the bottom, similar to an ogee, or cima recta roof.

Belt. A course of stones projecting from a brick or stone wall, generally placed in a line with the cills of the first floor windows; it is either moulded, fluted, plane, or enriched with patras at regular intervals, which may be either plain or fluted. It is commonly weathered on the upper side, from the face of the brick or stone work; and is throated on the under side to form a drip. It is sometimes called stone string.

Belvedere, or look-out. A turret, or lantern, raised above the roof as an observatory, or for the purpose of enjoying a fine prospect. Also a small edifice or temple, erected in gardens for a similar purpose. Belvederes are very common both in France and in Italy. See *Turret.*

Bench. A horizontal surface, supported about 2 feet 8 inches from the ground, on which joiners and cabinet-makers prepare and fashion their work.

Bench-hook. A pin affixed to the bench for the purpose of preventing the stuff that is being wrought from sliding.

Bend. See *Bending.*

Benda. See *Fascia.*

Bending. The act of the incurvation of a body from a straight to a crooked form. One of the best modes of bending a plank is, by enclosing it within a hollow prismatic trunk, and exposing it while in that situation to the action of steam, by means of a pipe, having a communication with a boiler, and with one of the ends or sides of the trunk. When the plank has been sufficiently exposed to the action of the steam, it is taken out of the trunk, and immediately bent round the convex surface of an inflexible body, prepared for the purpose. In this situation it is fastened, and allowed to remain till quite cold. Planks thus bent will retain the degree of curvature given them; and the practice of ship-building proves that planks of almost any thickness may be bent to any requisite curve, by the application of heat, or heated water, or by steam.

A plank may be bent, by affixing one of its ends to a stage erected for the purpose, so as to sustain it some height from the ground, in a horizontal direction, or in a direction as nearly horizontal as the weight of the other end of the plank, which is unsupported, will admit. A fire is then to be kindled beneath it: and while the under side of the plank is thus exposed to the heat of the fire, which will have a tendency to incurvate it, the upper side is supplied with cold water. In this operation, it is difficult to introduce a uniform temperature throughout the body to be bent; consequently, the other mode should, if possible, be resorted to.

Bernini, Giovanni Lorenzo, was born at Naples in 1598, and died November, 1680. His father, Peter Bernini, was a native of Tuscany, and practised sculpture with some distinction in his native place; but repairing thence to Naples, he married Angelica Galante, who gave birth to the subject of our present memoir Soon after his marriage, Peter Bernini was ordered to Rome by pope Paul V., to decorate the Paulina chapel, Santa Maria Maggiore. It was in this place, and while yet in his infancy, that the genius of Giovanni began to develope itself. Paul V., astonished to find a skilful artist in a child but ten years old, recommended him to the care of cardinal Maffei Barberini, as one who was likely to become the Michael Angelo of his age. Encouraged by the praises that he had received, he applied himself to his studies with the greatest diligence and attention; and before he had attained his eighteenth year, gave manifest proofs of his abilities. Among the productions of his youth, we may mention his statues of St. Laurence, and of Æneas carrying off his father at the siege of Troy; and more particularly his David and Goliah, which some have reckoned among his best works. To these may be added, his groupe of Apollo and Daphne, cut from a single block of marble, and the second not more than half a foot from the first, executed for cardical Borghese, which has been regarded as the *chef d'œuvre* of sculpture.

During the pontificate of Gregory XV., Bernini was created a knight of the order of Christ, whence he has been commonly distinguished by the appellation of *chevalier Bernini.* Upon the death of Gregory XV., his patron Barberini ascended the papal chair, under the title of pope Urban VIII.; and Bernini was appointed by him to carry into execution the projects he had formed for the embellishment of Rome. His first work was the decoration of the place called the "confession," in St. Peter's; and during the nine years that he was employed on it, he was very liberally rewarded. He also constructed a fountain, displaying the richness of his invention in the piazza d'Espagna; decorated the great niches of the pillars that support the dome of St. Peter's; and constructed a grand mausoleum for the pope, which is considered one of the finest ornaments of that cathedral.

Louis XIII. of France, having made some tempting offers to Bernini to induce him to go to Paris, pope Urban VIII. told him, that he was made for Rome, and that Rome was made for him; and, with a view to keep him in Rome, prevailed on him to marry. This union lasted thirty-five years, and produced a numerous offspring.

The grand fountain of the piazza Navona was constructed by Bernini, under the pontificate of Innocent X.; and the fine portico of St. Peter's was erected by him under the pontificate of Alexander VII. In 1664, he was consulted by Louis XIV. of France, in consequence of the recommendation of Colbert, concerning the improvement of the Louvre; and at the age of sixty-eight years, he yielded to an urgent invitation to visit Paris for that purpose. In his journey thither, he was honoured in various places through which he passed by the most respectful attention; and when he arrived in Paris and saw the front of the Louvre by Perrault, he said publicly, that his coming to France was useless, where there were artists of the first class. This trait does much more honour to Bernini, than all his abilities as an architect. His design for the completion of the Louvre was not executed. He made the king's bust; and during the eight months that he staid in France, he was paid at the rate of five pounds a day, and received at last a gift of fifty thousand crowns, and an annual pension of two thousand, and a pension for his son, whom he took with him, of five hundred.

He returned to Rome before winter, and as an acknowledgement of his obligation, for the civility and munificence with which he was treated by Louis, he formed a colossal equestrian statue, representing the king as supported by a rock. Upon its removal to Paris, Girarden changed it, on account of its want of sufficient resemblance to that monarch, into a Curtius leaping into a fiery gulph. Among the remaining works in which Bernini employed himself, the most considerable was the tomb of Alexander VII., in St. Peter's. Whilst he was repairing the old chancery palace, by order of Innocent XI., he was seized with a fever, which terminated in an apoplexy, that closed his life in 1680, in the eighty-second year of his age.

Bevel. In masonry, and among joiners, a kind of square; one leg whereof is frequently straight, and the other curved, according to the sweep of an arch or vault; being also movable on a point, or centre, so that it may be set to any angle. The make and use of the bevel are pretty much the same as those of the common square or mitre, except that these latter are fixed; the first at an angle of ninety degrees, and the second at forty-five; whereas the bevel being movable, may, in some measure, supply the office of both; and yet, which it is chiefly intended for, supply their deficiencies, serving to set off or transfer angles, either greater or less than ninety or forty-five degrees.

Bricklayers have also a bevel, by which they cut the under sides of the bricks of arches, straight or circular, to such oblique angles as the arches require, and also for other uses.

Bevel Angle is used among the workmen, to denote any other angle besides those of ninety or forty-five degrees.

The simple bevel, Plate G^4, *Geometry, fig* 1, consists of two rulers movable on a common centre, like a carpenter's rule, with a contrivance to keep them fixed at any required angle. The centre C must move on a very fine axis, so as to lie in a line with the fiducial edges CB, CD of the rulers, and projects as little as possible before them. The fiducial edges of the legs represent the sides of any given angle, and their intersection or centre C, its angular point. A pin, fixed in the lower ruler, and passing through a semicircular groove in the upper, serves, by a nut A, which screws upon it, to fix the rulers, or legs, when they are placed at the desired angle.

The use of this instrument may be illustrated in the following examples:

1. Let three points A, B, C, be in the circumference of a circle, which is too large to be described by a pair of compasses; and let it be required to find any other number of points in the same circumference. Bring the centre of the bevel to B (*fig.* 2.), the middle point of the three given ones A, B, and C, and holding it there, open or shut the instrument till the fiducial edges of the legs lie upon the other two points, and fix them there by means of the screw A (*fig.* 1.): this operation is called setting the bevel to the given points. Then removing the centre of the bevel to any part between B and A or C, the legs being at the same time kept upon A and C, that centre will describe, or be always found in, the arc which passes through the given points, and will thus ascertain as many others as may be required between the limits of A and C. In order to find points without those limits, proceed in the following manner: the bevel being *set*, bring the centre to C, and mark the distance CB upon the left leg; remove the centre to B, and mark the distance BA upon the same leg; then placing the centre on A, bring the right leg upon B, and the first mark will fall upon *a*, a point in the circumference of the circle, passing through A, B, and C, whose distance from A is equal to the distance BC. Removing the centre of the bevel to the point, *a*, last found, and bringing the right leg to A, the second mark will find another point, a'', in the same circumference, whose distance aa'' is equal to AB. By proceeding in this manner, any number of points may be found, whose distances on the circumference are alternately BC and BA. In the same manner, by making similar marks on the right leg, points on the other side as at c' and c'' are found, whose distances Cc', $c'c''$, are equal to BA, BC respectively. Intermediate points between any of the above are given by the bevel in the same manner with those between the original points.

2. Three points, A, B, and C, being given, to draw a line from any of them, tending to the centre of the circle, which passes through them all. Set the bevel to the three given points A, B, and C, (*fig.* 3.) lay the centre on A, and the right leg to the point C, and the other leg will give the tangent AG. Draw AD perpendicular to AG'' for the line required. For BAE being = BCA, the angle EAC is the supplement to the angle ABC, or that to which the bevel is set;

hence, when one leg is applied to C, and the centre brought to A, the direction of the other leg must be in that of the tangent GE.

3. Three points being given as before, let it be required to draw from a fourth given point, D, a line tending to the centre of a circle passing through the first three points. On D, (*fig.* 4.) with the radius DA describe an arc AK; set the bevel to the three given points A, B, and C, and bring its centre, always keeping the legs on A and C, to fall on the arc AK, as at H on A and H severally, with any convenient radius, strike two arcs, crossing each other at I; and the required line D*d* will pass through the points I and D. For a line drawn from A to H will be a common chord to the circles AHK and ABC; and the line ID bisecting it at right angles, must pass through both their centres.

4. Three points being given as before, together with a fourth point, to find two other points, such, that a circle passing through them and the fourth point, shall be concentric to that passing through three given points. Draw A*c* and C*c* tending to the centre, by a former problem; set the bevel to the three given points A, B, and C; bring the centre of the bevel to D, and move it upon that point till its legs cut off equal parts AN, CQ, of the lines A*a* and C*c*; and N and Q will be the points required. For, supposing lines drawn from A to C, and from N to Q, the segments ABC and NDQ will be similar ones; and consequently, the angles contained in them will be equal.

5. Two lines tending to a distant point being given, and also a point in one of them; to find two other points (one of which must be in the other given line), such, that a circle passing through these three points may have its centre at the point of intersection of the given lines. Draw EH (*fig.* 5.) at right angles to AB, and make FH=FE: set the bevel to the angle GDO, and keeping its legs on the points H and E, bring its centre to the line AB, which will give the point I.

An improved bevel is exhibited in *fig.* 6. by which the arcs of circles of any radius, without the limits attainable by a common pair of compasses, may be described. It consists of a ruler AB, composed of two pieces rivetted together near C, the centre or axis, and of a triangular part CFED. The axis is a hollow socket fixed to the triangular part, about which another socket, fixed to the arm CB of the ruler AB, turns. These sockets are open in the front for part of their length upwards, as represented in the section at I, which shows the point of a tracer, or pin, fitted for sliding in the socket. The triangular part is furnished with a graduated arc DE, by which and the vernier at B, the angle D*c*B may be determined to a minute. In this arc is a groove, by means of which, as well as by the nut and screw at B, or some similar contrivance, the ruler AB may be fixed in any required position. A scale of radii is put on the arm CB, by which the instrument may be set to describe arcs of given circles, not less than 20 inches in diameter. In order to set the instrument to any given radius, the number expressing it in inches on CB, is brought to cut a fine line drawn on CD, parallel and near to the fiducial edge of it, and the arms are fastened in that position by the screw at B. Two heavy pieces of lead or brass, G, G, made in form of the sector of a circle, the angular parts being of steel, and wrought to a true upright edge, as shown at H, are used with this instrument, whose arms are made to bear against those edges when the arcs are drawn. The under sides of these sectors are furnished with fine short points to prevent them from sliding. The fiducial edges of the arms CA and CD, are each divided from the centre C into two hundred equal parts. This instrument might be furnished with small castors, like the pentagraph; but little buttons, fixed on its under side, near A, E, and D, will enable it to slide with sufficient ease.

The use of this instrument may be exemplified in the following problems:

1. To describe an arc, which shall pass through three given points.—Place the sectors G, G', with their regular edges over the two extreme points; apply the arms of the bevel to them, and bring at the same time its centre C, that is, the point of the tracer, or pen, put into the socket, to the third point, and there fix the arm CB; then, bringing the tracer to the left hand sector, slide the bevel, keeping the arms constantly bearing against the two sectors, till it comes to the right hand sector, by which the required arc will be described by the motion of its centre C. If the arc be wanted in some part of the drawing *without* the given points, find by case 1. under *simple bevel*, other points in those parts where the arc is required; and thus a given arc may be lengthened as far as is necessary.

2. To describe an arc of a given radius, not less than 10 inches.—Fix the arm CB so that the part of its edge corresponding to the given radius, always reckoned in inches, may lie over the fine line drawn on CD for that purpose, bring the centre to the point through which the arc is required to pass, and dispose the bevel in the direction in which it is intended to be drawn; place the sectors G, G, exactly to the divisions one hundred in each arm, and strike the arc as above described.

3. The bevel being set to strike arcs of a given radius, as in the last instance, let it be required to draw other arcs, whose radii shall have a given proportion to that of the first arc. Suppose the bevel to be set for describing arcs of fifty inches radius, and it be required to draw arcs of 60 inches radius, with the bevel so set. Say, as 50 is to 60, so is the constant number 100 to 120, the number on the arms CA and CD, to which the sectors must be placed, in order to describe arcs of 60 inches radius. When it is said that the bevel is set to draw arcs of a particular radius, it is always understood that the sectors G, G, are to be placed at N°. 100 on CA and CD, when those arcs are drawn.

4. An arc ACB (*fig. 7.*) being given, let it be required to draw other arcs concentric to it, which shall pass through given points, e. g. P. Through the extremities A and B of the given arc, draw lines AB, BP, tending to its centre, by case 3, under *simple bevel*. Take the nearest distance of the given point P from the arc, and set it from A to P, and from B to P. Hold the centre of the bevel on C, any point near the middle of the given arc, and bring its arms to pass through A and B at the same time, and fix them there. Place the sectors to the points P and P, and with the bevel, set as before directed, draw an arc, which will pass through P' the given point, and be concentric to the given arc ACB.

5. Through a given point A (*fig.* 8.) in the given line, to strike an arc of a given radius, and whose centre shall lie in that line, produced if necessary. Set the bevel to the given radius, by case 2. Through A, at right angles to AB, draw CD; lay the centre of the bevel, set as above, on A, and the arm CA on the line AC, and draw a line AE along the edge CD of the other arm. Divide the angle DAE into two equal parts by the line AF, and place the bevel so that, its centre being at A, the arm CD shall lie on AF; while in this situation, place the sectors at N°. 100 in each arm, and then strike the arc.

6. An arc being given, to find the length of its radius.—Place the centre of the bevel on the middle of the arc, and open or shut the arms till N°. 100 on CA and CD, fall upon the arc on each side of the centre; the radius will be found on CB (in inches) at that point of it, where it is cut by the line drawn on CD. If the extent of the arc be not equal to that between the two Nos. 100, make use of the N°. 50, in which case the radius found on CB, will be double of that sought; or the arc may be lengthened by prob. 1. till it be of a sufficient extent to admit the two Nos. 100. "Adam's Geometrical and Graphical Essays," by Jones, 1797.

This work is now in its fourth edition, and may be had of W. and S. Jones, Mathematical Instrument Makers, No. 30, Holborn, London; and of all booksellers.

Bevel, Graduated. That which has about the centre of one of its arms a semicircle graven, and divided into one hundred and eighty degrees, whose diameter stands square with the sides of the same arm; so that the end of the other arm, being divided at right angles almost to the centre, shows by its motion the number of degrees contained in the angle to be measured. This is also called *recipiangle* and *pantameter.*

BILLET MOULDING. See *Moulding.*

BINDING JOISTS. Beams arranged in a floor, at from 3 to 4 feet apart, to support transversely the bridgings above, and the ceiling joists below. See *Bridging Floors, Trimmers, and Trimming Joists.*

BINDING RAFTERS. See *Purlins.*

BIRD'S-MOUTH. An interior angle, made in the upper end of a piece of timber, to shore up bressummers, &c. It is sometimes reversed, as in the foot of a rafter which butts against a plate.

BISTRE, OR BISTER. A composition made of the most glossy and highest burnt soot, pulverized and passed through a fine sieve, then baked in a little gum water and made into cakes; or it is the burnt oil, extracted from the soot of wood. It is of a brown transparent colour, and has much the same effect in water painting, where alone it is used, as brown pink has in oil.

The best is prepared from the soot of dry beech wood, by grinding in with urine or water, into a smooth paste, and then diluting it with more water; after the grosser substance has subsided, the liquor is poured off into another vessel, and left to settle three or four days: the fine matter that remains is bistre. That which is good is transparent when moistened with water, and of a warm deep brown colour.

Another mode of making it is, by putting the soot of dry beech, or other wood, into water, in the proportion of two pounds to a gallon, and boiling them for half an hour. Then, after the fluid has stood some time to settle, but while yet hot, pour off the clearer part from the earthy sediment at the bottom; and if on standing longer, it form another earthy sediment, repeat the same method; but this should be done only while the fluid remains hot. Evaporate the fluid to dryness; and that which remains will, if the soot were of the proper kind, be good bistre.

Bit. See *Stock and Bit.*

Bitumen. A tenacious matter, used in former ages instead of mortar. The walls of Babylon are said to have been cemented with this matter.

Blade of a chisel. See *Chisel.*

Blade of a saw. See *Saw.*

Blank-door. A doorway that has been blocked up to prevent entrance: also a false door placed in an apartment opposite to the real door, or in a correspondent recess to that in which the real door is, for the sake of uniformity.

Blank-window. Sash-frame, sashes, and glass, fixed into a recess corresponding with the real windows, to preserve the uniformity of an elevation. Behind the sash the brickwork is usually plastered and painted black.

Blinds. Consist generally of two quadrangular frames, hung with hinges to the bead at each extremity of a window. Each of these frames are made of mahogany, or other wood, having vertical laths, about seven-eighths of an inch wide, and the eighth of an inch thick, affixed to two horizontal pieces, the one at the top and the other at the bottom, in lines that are parallel to, and nearly touching, the upper and lower bars of the quadrangular frame. The vertical laths are so arranged with regard to each other, that when they are moved, either to the right or left, by means of a small lever or thumb screw connected with the upper horizontal piece, they fall over each other, and prevent passengers, and others, from looking into the interior of an apartment.

Blinds, venetian. Consists of a series of thin pieces of wood, about 2 inches and a half or 3 inches wide, and a sixth of an inch thick, suspended by means of tapes, attached to two rollers, from the top of a window, in a horizontal direction, and so arranged with regard to each other, that, when their breadth is inclined, they lap over, and effectually exclude the sun's rays. In each of these thin horizontal pieces, at a certain distance from each of the ends, two holes are made, through which cords, fastened at the bottom, ascend, and thence, passing over pullies, descend to a convenient height from the ground. By pulling these cords, and *vice versâ*, the blinds can be drawn up and let down at pleasure.

Block of wood. A piece of wood cut into a required shape for some particular purpose.

Block of marble. A piece of marble in the rough, out of which one or more things may be made.

Blocking, or blocking-course. *In Masonry.* A course of stones placed on the top of a cornice, crowning the walls.

Blockings. *In Joinery.* Small pieces of wood, fitted and glued to the interior angle of two boards, or other pieces, with a view to strengthen the joint. In gluing up a column, the staves are all successively glued, and strengthened with blockings; as also are the treads and risens of stairs; and in short, every other sort of joint, which requires additional strength. Blocks are always hidden from the sight.

Blondel, Francis. An eminent mathematician and military engineer, was born in 1617, at Ribemont, in Picardy. In 1652, he was appointed travelling governor to the young count of Brienne. After a tour of three years he returned, and was advanced to considerable posts, both in the army and navy, and was employed in various negotiations with foreign princes. In 1659, being deputed by Louis XIV. as his envoy-extraordinary to Constantinople, he visited Egypt, and at the termination of his embassy, was appointed counsellor of state, tutor in mathematics and belles-lettres to the dauphin, and one of the mathematical professors of the Royal College. In 1665, he began to display his talents for architecture, and was employed by the court to construct a bridge over the Charante, at the town of Saintes. In 1670, he was honoured with letters patent from the king, for the superintendence of all the public works in Paris. To him were intrusted the repair and decorations of the gates of St. Anthony and St. Bernard; and the gate of St. Denis, one of the most finished pieces of French architecture, was designed and erected by himself. In the office of director and professor of the Academy of Architecture, established in 1671, he gave "a Course of Architecture," which was published in large folio, in 1698, and was long considered as a standard book. He published many other philosophical works, and died in Paris, February 1, 1686.

Blondel, John Francis. An eminent architect, was born at Rouen, in 1705, and died, January 9, 1774. He constructed the royal abbey of St. Louis, and also a street and square, leading directly opposite to the cathedral; likewise the town-house, on an elevated site, with a building opposite; farther on he constructed barracks, with magazines over them, and opposite, the fine front of the parliament; and, finally, the sumptuous palace of the bishop in a regular square. In 1768, he took a plan of Strasburg, and to make it regular, built barracks for infantry and cavalry, a hall or amphitheatre with three tiers of boxes, a royal square, a senate-house, a market, and various stone bridges. He was known not only as architect to the king, member of the Academy of Architecture, and royal professor of the arts at the Louvre, but by several useful publications: as, "A Discourse on Architecture," 12mo; "A Treatise on the Decoration of Buildings," 1738, two vols., 4to; a work of great utility, called, "A Discourse on Architecture," six vols., 8vo., 1771, 1773. He was also the author of the articles relating to architecture in the "Encyclopædia;" and after his death a posthumous work of his was published, entitled, "L'Homme du Monde éclairé, par les Arts," two vols., 8vo.

Boarded-floor. See *Floor.*

Boarding joists. Joists in naked flooring to which the boards are fixed.

Boarding for leaden platforms and gutters. The boards used for this purpose are generally from an inch and an eighth, to an inch and a quarter thick, and frequently have only rough joints.

Boarding for lining walls. Boards of this description are from about five-eights to three-quarters of an inch thick, and are ploughed and tongued together.

Boarding, luffer. See *Luffer-Boards, and Lever Boards.*

Boarding for pugging, or deafening. See *Sounding Boards.*

Boarding for slating. See *Slating*.

Boards, lever. Boards placed in the opening of an aperture, and made to turn on centres, to admit or shut out the air at pleasure.

Boards listed. Boards reduced in breadth by taking away the sap wood.

Boasted, or boasting-tool. See *Tools used by Masons*.

Boasting. *In Stone-cutting* The paring of a stone with a broad chisel and mallet.

Body of a niche. See *Niche*.

Body-range of a groin. See *Groin*.

Boffrand, Germain. A celebrated French architect and engineer, was born at Nantes in 1667, and having been educated at Paris, he employed himself for some time in sculpture during the winter, and studied architecture in the summer. His talents at length engaged the attention and patronage of Hardouin Mansart, an eminent architect, who obtained for him a place in the commission for the royal buildings. In 1709, he became a member of the Royal Academy of Architecture, and was much employed at Paris, and by several German princes, in furnishing designs for various edifices. His style of building was grand and noble, and formed after the model of Palladio. He was likewise a skilful engineer, and constructed a great number of canals, sluices, bridges, and similar works. As architect to the general hospital of Paris, he gratuitously served the institution; and, as he was disinterested in his temper, he was lively and amusing in conversation; and he indulged his taste for literature, by the composition of several pieces, adapted to the purpose of producing temporary mirth and gaiety, for the Italian comedy. His "Book of Architecture," with plates, in folio, was printed at Paris in 1745; and contains an account of the general principles of the art, exemplified in his own works. In this work he has introduced a curious memoir, describing the method of casting the bronze equestrian statue of Louis XIV. He retained his gaiety of disposition to the age of eighty-seven years; and died in Paris in 1755.

Bolsters of the ionic capital. See *Baluster*.

Bolt. *In Joinery*. An iron fastening for a door, moved by the hand, and catching in a staple or notch to receive it. Bolts are of various kinds, of which plate, spring, and flush bolts, are for fastening doors and windows.

Bolts are also large cylindrical iron pins, having a round head at one end, and a slit at the other. Through this slit a pin or forelock passes, to make fast the bar of a door, window-shutter, or the like. These are generally called round bolts, or window bolts.

Bolt of a lock. The iron part that enters into a staple or jamb, when the key is turned, to fasten the door. Of these there are two sorts; one shuts of itself by only putting to the door, and is called a *spring-bolt*; the other, which only moves by the application of a key, is called a *dormant-bolt*.

Bolt of iron. *In Carpentry*. A square or cylindrical piece of iron, with a knob at one end and a screw at the other, made to pass through holes made for its reception in two or more pieces of timber, to fasten them together, by means of a nut screwed on the end that is opposite to the knob.

Bomon. *In Grecian Antiquity*. An altar to a god.

Bonarrotti, Buonaroti, Bonarota, Michael Angelo. A celebrated painter, sculptor, and architect, was born at the castle of Chiusi, in the territory of Arezzo, in Tuscany, in 1474. He was sent to be nursed at his father's villa, called Settignano, situate about three miles distant from Florence, and was intrusted to the care of a woman, who was the wife of a stone-mason, and who was also the daughter of a person of the same employment: hence Michael Angelo sometimes facetiously remarked, that it was no wonder that he was delighted with a chisel, since it was given to him with his nurse's milk.

His talents for designing and painting were so early developed, that he is figuratively said to have been *born a painter*. His father and his uncles perceiving the bias his mind had taken often treated him harshly, conceiving that the arts would degrade the dignity of the family; but, though their displeasure was to Michael Angelo a source of great uneasiness, it could not restrain the natural bent of his inclination. His father, therefore, perceiving it was hopeless to give his mind any other direction, resolved, by the advice of his friends, to place him under Dominico Ghirlandaïo, who had then a numerous school of pupils, and was himself one of the most celebrated painters in Italy.

Michael Angelo's progress in the arts was so rapid, that he soon surpassed not only his contemporary students, but even his master Ghirlandaïo; which excited so much jealousy, that one of his fellow students, named Torrigiano, gave him such a blow on the nose, that he carried the marks of it to his grave. Lorenzo de Medicis, one of the greatest patrons the arts ever had, being desirous of establishing a school for sculpture in Florence, made a garden near to the piazza of St. Mark, which he amply supplied with antique statues, basso-relievos, busts, &c.; and requested Ghirlandaïo to permit any of his scholars to study there, who were desirous of drawing from the antique. Of this permission Michael Angelo availed himself; and, having attracted Lorenzo's attention, was taken under his immediate patronage.

In the house, or rather palace, of his patron, Michael Angelo was provided with a room, and every accommodation that he could desire; he was introduced to men of rank and genius, and his leisure hours were passed with Lorenzo himself, in examining and contemplating his extensive cabinet of gems and medals.

The death of Lorenzo, which happened on the 8th of April, 1492, and the troubles of the house of Medici, caused Michael Angelo to remove to Bologna, where he executed an image of Cupid; and, having broken off one of its arms, took the image to Rome, and buried it in a vineyard. As he intended, the statue was soon found by the labourers, and sold as an antique to cardinal St. Gregory, for two hundred ducats. The cardinal had not been long in possession of his treasure, before Bonarrotti made known his pretensions, and produced the other arm to confirm his assertions. This established his reputation as a sculptor. Though the cardinal bestowed the most flattering commendation on our artist, he gave him no commission; but, his abilities being now known, he was employed by a Roman gentleman, and by cardinal Rovano. For the first he executed a statue of a Cupid, and another of a Bacchus; and for the last a groupe in marble, of the virgin with a dead Christ in her lap, called in Italy, *La Pietà*. This last was so much admired, that it gave him the precedence of his contemporaries.

From this time, 1498 to 1503, he executed many excellent works, and in the year last mentioned produced his celebrated painting, or cartoon, of the war between the Florentines and the Pisans. In his thirtieth year, he was commissioned by pope Julius II. to construct a grand mausoleum; but before it was finished, he returned to Florence in disgust, from having been refused admission to the pope, with whom he had been on terms of the strictest intimacy. The pope was no sooner informed of his hasty departure, than he sent five couriers after him, to reconduct him to Rome; but he was not overtaken until he was in a foreign state, where their authority was useless. He purposed going thence to Constantinople, whither he had been invited by the grand signior, to build a bridge between Constantinople and Pera; but Solderini. the gonfalonier, or holy standard-bearer, diverted his attention, and prevailed on him to return to Rome. He had an interview with the pope at Bologna, and was immediately restored to his friendship. Soon after this, and in the thirty-fourth year of his age, he was appointed to decorate with paintings, the ceilings and walls of the Sistine chapel; which stupendous work, however difficult it may be to credit, was actually begun and completed by him in twenty months.

From the time of the death of Julius II., which happened on the 21st of February, 1513, to the end of the pontificate of Leo X., in December, 1521, there is an entire blank in the life of Michael Angelo, he having been employed, much against his inclination, by that pontiff, in opening the marble quarries of Pietra Santa, in the territories of Florence. Upon the death of Leo, cardinal di Tortoso was chosen to fill the papel chair, by the title of Adrian VI.; and during his short reign, our artist was commissioned by cardinal Giuliano de Medici, who at that time held the government of Florence, to build a library and new sacristy to the church of St. Lorenzo, to serve as a mausoleum for the Medici family; and to execute monuments to the memory of the dukes Giuliano and Lorenzo, to be placed in it. Adrian died in September, 1523, and was succeeded by cardinal Giuliano de Medici, with the title of Clement VII. During the wars that now followed, Michael Angelo was appointed military architect and master of the ordinance; and in that capacity, he fortified Monte San Miniato, a height commanding Florence and the surrounding country. On the capitulation of the city, he, knowing the vindictive spirit of the pope, hid himself in an obscure retreat by the assistance of a friend, to whom alone the knowledge of his seclusion was intrusted. The pope, finding all his attempts to discover him were ineffectual, issued a proclamation, offering him a free pardon, on condition that he would finish the two monuments of Giuliano and Lorenzo de Medicis, already begun in the church St. Lorenzo.

On the death of Clement VII. on the 25th of September, 1534, Paul III. succeeded to the pontificate. Bonarrotti now commenced painting the great work of the *Last Judgment* in the Sistine chapel; but, according to Vasaria, it would appear, that this cartoon was begun about nine months before the death of Clement VII.; and from a letter still existing, written by Michael Angelo himself to Pietro Aretino, he had not entirely finished the composition in the year 1537, two years after the decease of that pontiff, although he was then advancing it in fresco. Whatever may have been the precise date of the commencement of this picture, it was finished in the year 1541, and the chapel opened on Christmas day. Persons are described to have come from the most distant parts of Italy to see it, and the public and the court were rivals in admiration. Near to the Sistine chapel, in the Vatican, Antonio de San Gallo built another chapel by order of Paul III., which, in like manner, is called after its founder, the chapel Paolina; and the pope, being solicitous to render it more honourable to his name, commissioned Michael Angelo to paint the walls in fresco. Although he now began to feel that he was an old man, (being in his sixty-seventh year,) he undertook the commission, and on the sides opposite to each other, painted two large pictures, representing the conversion of St. Paul, and the crucifixion of St. Peter; and at the desire of his holiness, he constructed the bold projecting cornice that surrounds the top of the Farnese palace.

In the year 1546, San Gallo, the architect of St. Peter's, died, and Michael Angelo, in the seventy-second year of his age, was called upon to fill the situation. He at first declined the honour, but the pope laid his commands upon him, which admitted neither of apology nor excuse; he, therefore accepted the appointment upon these conditions; that he should receive no salary, and that it should be so expressed in the patent, since he undertook the office purely from devotional feelings; and that, as hitherto the various persons employed in all the subordinate situations had only considered their own interest to the extreme prejudice of the undertaking, he should be empowered to discharge them, and appoint others in their stead; and lastly, that he should be permitted to make whatever alterations he chose in San Gallo's design, or entirely supply its place with what he might consider more simple, or in a better style. To these conditions his holiness acceded, and the patent was made out accordingly.

San Gallo had left a model for finishing this building, which had cost upwards of a thousand pounds, and had occupied some years in making. The first use that Bonarrotti made of his extensive commission was, to set aside this model; and in the space of fifteen days he produced another, for the small sum of twenty-five crowns, by which he proposed to raise the building with far greater facility and expedition, and with more majestic grandeur, than the plans of any of his predecessors could have given it This model, which was on the plan of a Greek cross, met with the pope's approbation; for, although the dimensions were less, the form was more grand than that of San Gallo's model. It appears by a letter of Michael Angelo, still extant, that he had a high opinion of Bramante's general plan, and would most probably have adopted it, with trifling alterations, if the difficulty of raising money had not made it necessary to contract the original size, to meet the exigencies of the times. Bramante had erected the four great piers, by which the cupola was to be supported, but they were so very weak, that the architects who succeeded him had found it necessary to give them additional strength. Bonarrotti, thinking them still insufficient for the purpose, enlarged them to their present gigantic size, and contrived to leave voids like wells in them, probably for the purpose of keeping them dry. He also left similar vacuities in the principal walls, through which he carried a winding staircase, so wide, and upon so gentle an ascent, that he was enabled to convey materials on beasts of burthen, to the height of the level of the arches. Bonarrotti lived to see the building carried to the height of the tambour on which the cupola was to be laid, when, on account of his age, his friends urged him to frame a model of the dome, as will be seen hereafter.

Notwithstanding that the building of St. Peter's might reasonably be supposed more than sufficient for the attention of an old man, it was but a part of his extensive engagements. He was commissioned to carry on the building of the Farnese palace, left unfinished by the death of San Gallo; and employed to build a palace on the Capitoline Hill for the senator of Rome, two galleries for the reception of sculpture and pictures, and also to ornament this celebrated site with antique statues and relics of antiquity, from time to time dug up, and discovered in Rome and its environs. These buildings form the three sides of a square, and the principal entrance on the fourth is defined by balustrades, and ornamented with statues and fragments of antiquity. At this time he also made a flight of steps leading up to the church of the convent of the Araceli, situated on the highest part of the hill, where anciently stood the temple of Jupiter Capitolinus, and where there are now some columns, supposed to have made a part of that celebrated building.

In the year 1555, pope Julius III., who had succeeded Paul III., died, and was succeeded in the papal chair by Marcellus II.; but he dying in the same month that he was advanced to the pontificate, the election fell on Paul IV. Michael Angelo Bonarrotti, now in his eighty-first year, was consulted with respect to strengthening the fortifications of Rome: and during the troubles which now followed, he employed himself on a groupe of sculpture, "Christ taken down from the cross." In Bonarrotti's eighty-fifth year, Pius IV. was elected to the pontificate: and notwithstanding his duties as architect to St. Peter's, he, at the desire of the pope, made a number of designs for the gates of the city of Rome, for which that called "Porta Pia" was carried into execution. He also converted the ruined baths of Dioclesian into a christian church; and was employed by the cardinal Santa Fione to build a chapel in St. Maria Maggiore, but which remained unfinished in consequence of the death of the cardinal, and was afterwards completed from the original designs by Giacomo della Porta.

Having now attained his eighty-seventh year, his friends urged him to form a model of his intended dome for St. Peter's, lest what he had already done should be spoilt by the incapacity or whim of a succeeding architect. With this request he complied, and formed one of clay, which was universally admired. This model was afterwards made of more durable materials by Giovanni Farnese; and St. Peter's was finally executed according to it in the pontificate of Sextus V. See *Basilica.*

Michael Angelo Bonarrotti was attacked by a slow fever in February, 1563, and died on the seventeenth day of the same month, aged eighty-nine years. His body was transported to Florence, where it received the most splendid funeral honours, and a superb mausoleum was erected to his memory, at the expense of the grand duke. His method of execution is thus spoken of by M. Vigeneres, a writer of the sixteenth century:—"I saw Michael Angelo when sixty years of age, and by no means of the most robust habit of body, strike off more chips from a very hard piece of marble, in less than a quarter of an hour, than three young masons would have done in three or four hours: a fact incredible to any who had not been eye-witnesses. He struck with such impetuosity and fury, that I expected to see the work broken to pieces; taking off at a single blow large pieces, 3 or 4 inches thick, and so close to the mark, that had the tool gone beside it never so little, the whole must have been spoiled, as the work would admit of neither reparation nor pargeting, like those in stucco and argil." But perhaps the highest, as also the most just, commendation that we can give him is, to repeat the words of sir Joshua Reynolds, in the spirited and masterly sketch which he has given of the character of Michael Angelo, in his "Discourse delivered to the Students of the Royal Academy," December 10, 1790. He is there described, "as the exalted founder and father of modern art, of which he was not only the inventor, but which he, by the divine energy of his own mind, carried at once to its highest point of possible perfection."—"Were I now to begin the world again," says sir Joshua, "however unequal I feel myself to that attempt, I would tread in the steps of that great master; to kiss the hem of his garment, to catch the slightest of his perfections, would be glory and distinction enough for an ambitious man. I feel a self-congratulation in knowing myself capable of such sensations as he intended to excite. I reflect, not without vanity, that these discourses bear testimony of my admiration of that truly divine man; and I should desire that the last words which I should pronounce in this academy, and from this place, might be the name of Michael Angelo." Duppa's "Life of Michael Angelo," sir Joshua Reynolds's "Discourses," &c.

Bond. The manner of making two or more bodies fast together.

Bond. *In Masonry, or Brickwork.* The disposition of stones or bricks in a building. It is a principle in building never to allow two vertical joints to fall upon one another; but to make the vertical joint that is between two bricks or stones in one course, fall upon the body of the brick or stone in the course below.

In brickwork, there are two descriptions of bond—the *English bond,* and the *Flemish bond.* In the *English bond,* a row of bricks is laid lengthwise on the length of the wall, and is crossed by another row, which has its length in the breadth of the wall, and so on alternately. Those courses, in which the lengths of the bricks are disposed through the length of the wall, are termed *stretching courses,* and the bricks, *stretchers;*

and those courses in which the bricks run in the thickness of the length of the walls, *heading courses*, and the bricks, *headers*.

The other description of bond, called *Flemish bond*, consists in placing a header and a stretcher alternately in the same course. This is deemed the neatest and most elegant; but, in the execution, is attended with great inconvenience, and, in most cases, does not unite the parts of a wall with the same degree of firmness as the English bond. See *Masonry and Brickwork*.

Bond-heart. When two stones placed in a longitudinal position extend the exact thickness of a wall, another stone is frequently put over the joint in the centre of the wall: this is called heart-bond.

Bond-stones. Stones used in uncoursed rubble-walling, having their length placed in the thickness of the wall. These stones are placed at regular intervals, both horizontally and vertically, so that every stone of one row falls on the vertical joint that is in the course below. Bond-stones inserted the whole thickness of the masonry are called *perpends*, or *perpend-stones*.

Bond-timbers. Timbers placed in a horizontal direction in the walls of buildings, in tiers, at certain distances apart, and on which the battens, laths, &c. are secured: also the horizontal mouldings, or finishings of wood

Common-bond implies timbers disposed in tiers at certain heights, corresponding to the height of the horizontal mouldings in the finishing of apartments, as behind bases, surbases, and skirting. The scantling of common-bond is about 2½ inches thick in the direction of the course of bricks, and 4 inches broad in its depth in the wall.

Chain-timbers, or *chain-bond*, are timbers placed in or near to the middle story of a building, and arranged similarly to common-bond. They are twice the size of the common-bond; being 5 inches thick in the direction of the course of brickwork, and imbedded 8¼ inches in the wall.

Bond-timber is difficult to execute in rubble-work, owing to the necessity there is of bringing the upper surface of the stone to a perfect level, to admit of the insertion of the timber; consequently, in work of this description, the walls are better plugged, which is effected by inserting plugs of wood in the wall at requisite distances, to secure the laths and battens. Both bond-timber and plugging have their respective advantages. Bond-timber, having its length placed horizontally in the wall, has a tendency to secure the walls from cracks, should the foundations of the building be bad: and plugging, though possessing not the same advantage in this respect, has another, of which the former is deficient; that is of making the walls much less liable to crack and fall in case of fire. When the lintels of a range of windows are considerably below the ceiling in a brick building, the lintels may be carried throughout the walls as bond-timbers; in such case, the thickness of the bond is regulated by the thickness of the lintels: and when bond-timbers act as the wall plates of floors or roofs, they have generally the same scantling as the chain-bond.

Bonds. This general term includes the whole of the timbers that are disposed in the walls of a building, as bond-timbers, wall-plates, lintels, and templets. See *Fir-in-bond*.

Bons. To make or judge of a

plane surface by the direction of the eye. For example, when an architect has alloted out a portion of ground to several builders, for them to erect houses, to form a street on a given plan, and which street, we will suppose, is to be in continuation of another already begun, he will place a rod at any given distance, with its vertical surface in a line with the walls of the houses already begun, and placing his eye close to the vertical surface of that rod, and looking thence down the intended line of street, will be enabled to ascertain whether the builders are erecting their houses conformably to the given plan; that is, with their surfaces in a line with the surfaces of those already built. If this should not be the case, he must make them alter them accordingly. In cases where an architect has to form a new street, not in continuation of another, he may erect two or more poles each of which has has one of its sides perfectly vertical, to bone by. This term is of very frequent use among architects, surveyors, and every one connected with the art of building.

Boning. The act of judging of, or making a plane surface by the direction of the eye. By boning with two straight edges, joiners, and others, try whether their work be out of winding.

Book-case. See *Library.*

Booth. A stall or standing in a fair or market; the term is also applied to any temporary structure, designed for shade and shelter.

Border. Pieces of wood put round the upper edges of any thing, either as useful or ornamental: thus the three pieces of wood which are mitred together round the slab of a fire-place are called the border.

Boring. The act of perforating a solid. For the tools used in the boring of wood, see *Stock and Bit.*

Borromini, Francis. An Italian architect, was born, in 1599, at Bissona, in the diocese of Como. In his seventeenth year, he repaired to Rome, and Carlo Maderno, who was his relation, and the architect of St. Peter's, perceiving that he had talents and perseverance, had him instructed in geometry. Borromini's progress was such, that Maderno employed him in the making of fair copies from his designs, and also employed him in some works that he had to execute for pope Urban VIII. Amidst these occupations, Borromini found time to execute in sculpture the cherubim on either side of the small door of St. Peter's, which, with the drapery and festoons over the arches, are the only works of his chisel. On Maderno's death, in 1629, Bernini was appointed the architect of St. Peter's, and Borromini worked under him; but the latter, becoming first emulous, then envious, and finally the enemy of Bernini, endeavoured to get other commissions; and, in fact, was employed about the church of Sapienza, and the Barbarini palace, the convent of St. Philippe de Neri, the churches of the college Propaganda, and of St. Agnes, and in decorating St. Jean-de-Latran. The reputation he acquired by these works induced the king of Spain to engage him to furnish a design for the enlargement of his palace at Rome; and though it was never executed, he received the liberal recompense of a thousand pistoles, and was honoured with the order of St. James. The pope also bestowed upon him the order of Christ, and a pension. He was now intrusted with the building of St. Andrew, the restoration of the palace of the Falconieri at Rome, and those of Della Ruffini and of the prince Scavolina, with numerous other works; but in this career of prosperity, his jealousy of Bernini was such, that, with an attempt to surpass him in novelties, he laid aside the common rules, and bewildered his imagination and talents in a labyrinth of extravagances. He, by these means incurred the censure of several critics; and he was charged, by Bernini, with corrupting the sound principles of the art. The clamour against him prevailed, and his rival obtained the direction of a building, for which he had prepared the designs; upon which he retired in disgust into Lombardy. On his return, he employed himself in preparing a set of grotesques for engraving; but the mortification he had experienced preyed upon his spirits, and produced occasional derangement of mind; and in one of his paroxysms, he seized a sword and gave himself a mortal wound, in the sixty-eighth year of his age.

Borromini affected singularity, and indulged a capricious and fantastic taste in his designs and decorations, which was utterly inconsistent with simplicity and propriety. Accordingly, some have represented his style in architecture as resembling the literary style of Seneca, and the poet Marino. Vain of his own imagined superiority, and jealous of his brethren, he declined to concur with them; and before his death, destroyed all his designs, lest any other architect should pass them off as his own. His best work, among many performances, in churches and palaces at Rome, which blend striking beauties with singularity, is accounted to be the college of the Propaganda. The oratory of the Chiesa Nuova, notwithstanding that it has undulating coronæ, delicate mouldings under great weights, mouldings of a strange and new form, breaks in the architrave of the entablature only, with prominences, contortions, and every kind of absurdity, has a something that is harmonious and handsome; but, as Bernini has very justly observed, it is more adapted to a country house, or villa, than to the second edifice of a city. The house of the fathers has also been admired.

Bosphoricum marmor. A name given by the ancients to a species of marble, of a yellowish white colour, with beautiful veins of a somewhat darker hue; called also, from its transparency, *phengites*.

Boss, or bosse. *In Sculpture.* Signifies relievo, or prominency. The word is French, *bosse*, which signifies the same; whence also to emboss.

Boss, *among Bricklayers.* A hod without a staff, wherein the labourers put the mortar to be used in tiling. It has an iron hook, by which it may be hung on the laths, or on a ladder.

Bossage. A projecting stone, laid rough in building, to be afterwards carved into mouldings, capitals, arms, or the like. Bossages also denote rustic work, which seems to advance before the naked of a building, by reason of indentures, or channels, left in the joinings; used chiefly in the corners of buildings, and thence called rustic coins. The cavities, or indentures, are sometimes square, sometimes chamfered or bevelled, sometimes circular, and sometimes in the diamond form: sometimes they are enclosed with a cavetto, and sometimes with a listel.

Bott, Jean de. An architect, born in France, in 1674, and died in Dresden, in 1745. He accompanied William, prince of Orange, afterwards king of England, to this country; and after that prince's death, repaired to Brandenburgh, where he was made captain of the guards, and built several structures, particularly the celebrated arsenals at Berlin. He was afterwards raised to the rank of major-general, and displayed his skill in the construction of the fortifications of Weissel, of which he was commandant. In 1728, he entered into the service of the king of Poland, as lieutenant-general, and chief of the engineers.

Bouchardon, Edmond. A French sculptor and architect, was born in 1698, at Chaumont, in Bassigny, where his father exercised those arts, and was educated in Paris, in the school of Couston the younger. He erected several fine buildings in Paris; and having acquired a decent fortune by his industry and regularity, and attained high eminence in his profession, he died in 1762.

Boulanger, Nicholas Anthony. An architect and a mathematician, was born in Paris in 1722, and died in 1759. He accompanied the baron de Thiers to the army, as engineer; and, on his return, was employed in the construction of bridges and causeways and executed various public works in Champagne, Burgundy, and Lorraine. He was a good scholar, wrote several works, and contributed the articles, "Deluge,"—"Carvée," and "Society," to the "Encyclopædia."

Boulder-walls, are those built of round flints or pebbles, laid in a strong mortar. Walls of this kind are usually built where the sea has a beach cast up, or where there is plenty of flints.

Boultine, or boltel. The workmen's term for a convex moulding, whose periphery is just a quarter of a circle next below the plinth, in the tuscan and doric capitals. This moulding is not at present in use.

Bound masonry. See *Masonry.*

Boutant. An arc boutant is an arch or buttress, serving to sustain a vault; and which is itself sustained by some strong wall, or massive pile. The word is French, and comes from the verb *bouter*, to but, or abut. A *pillar boutant* is a large chain or pile of stone, made to support a wall, terrace, or vault.

Bow. That part of a building which projects from a straight wall, most commonly of the form of a segment of a cylinder, though sometimes it is built on a plan consisting of three sides. In the first, the plan is the arc of a circle; and in the second, it is two external obtuse angles, formed by the two projecting walls and the wall which unites them, and two internal obtuse angles, formed by the two projecting walls and the straight wall of the building from which they project. Sometimes the bow is carried the whole height of a building, and sometimes it is carried no higher than to the first or second stories.

Bow. *Canted, or polygonal.* A bow which has three, four, or five vertical sides, raised from a polygonal plan; or from a prism, so disposed.

Bow. A beam of wood, or brass, with three long screws, that governs or directs a lath of wood or steel to any arch; chiefly used in drawing draughts of ships, and projections of the sphere, or wherever it is requisite to draw large arches.

Bow. See *Drill-bow.*

Bow-compass. See *Mathematical Instruments.*

Bow-room. A room that includes part of the bow of a building.

Bow-saw. See *Saw.*

Bow-window. A window placed in the bow of a building. (See *Oral Window.*) The building act requires, that no bow-window, or other projection shall be built to any building of first, second, third, or fourth rate, except such projection or bow-window was originally built with the house or building to which the same belongs, or unless such bow-window or other projection be within the original line of the street, square, place, court, or way, in which it is erected. And none shall be built with, or added to, any first, second, third, or fourth rate building, unless the same, and the columns and pilasters, if any, belonging to the same, be built of the materials directed for external enclosures.

Box. This word, in its most general acceptation, denotes a case for holding things.

Box of a rib-saw. Two thin iron plates fixed to a handle. In one of these iron plates is an opening to receive a wedge by which it is fixed to the saw.

Boxings of a window. Two cases, one on each side of a window, and opposite to each other, into which the shutters are folded, or fall back. Shutters of principal rooms are most commonly made in two distinct divisions or halves, each of these divisions having as many subdivisions or leaves, as are requisite for their being folded within the boxings. These subdivisions or leaves rarely exceed three in number: and are so arranged, that that subdivision, or leaf, whose face is visible, termed the front-shutter, is flush with, and of, the exact breadth of the boxings; that the second, which is hidden in the boxing, is less in breadth than the first; and the third less in breadth than the second. For example, suppose a window 4 feet wide be placed in a wall that is two bricks, or 18 inches thick: then, with a view to ascertain the number of subdivisions or leaves, each of the principal divisions of a shutter should have add to the thickness of the wall that of the lath and plaster, say 2 inches: thus 18 + 2 = 20 inches; and from the thickness of the sash-frame, 6 inches, and the distance of the sash-frame from the face of the building, 4½ inches, thus 20 − 6 − 4½ = 9½ inches. This will give three leaves, or subdivisions; and, as it is customary to make the *back-flaps*, or those which fold back completely within the boxings, less than the *front-shutter*, or that whose face is visible, (being flush with, and of the exact breadth of, the boxings,) they may be arranged thus,—front shutter, or first leaf, 9½ inches, second leaf 8 inches, and third leaf 6½, which gives 24 inches, the size of each of the principal divisions. In this calculation, the reader will perceive that we have made no allowance for the shutters being rebated into each other, as is frequently the case; when shutters are therefore rebated into each we must allow four-eighths of an inch more for the two rebates of the three leaves, and one-eighth of an inch for the rebate at the meeting of the two principal divisions in the middle of the window, making with the breadth of the three subdivisions 24 + ⅝ = 24⅝ inches; the flaps may therefore be arranged thus, first leaf 9½ inches, the second leaf 8½, and the third leaf 6⅝ which is equal to 24⅝ inches, the full extent of each principal division.

To ascertain the depth of the boxings, add to the thickness of each of the leaves one-sixteenth of an inch; and if there be a back-lining add the thickness of that to the account. As the second and third leaves are generally made thinner than the first leaf, it may, in the present case, stand thus,—first leaf $1\frac{1}{2}$ inch, second leaf $1\frac{1}{4}$, and third leaf $1\frac{1}{4}$; to which add $\frac{3}{16}$ for the three leaves, and the amount will be $1\frac{1}{2} + 1\frac{1}{4} + 1\frac{1}{4} + \frac{3}{16} = 4\frac{3}{16}$ inches for the depth of the boxing.

When walls are only a brick and a half thick, or the windows of an apartment are very wide, it is usual to make the architrave project considerably before the plaster, or to bring the lath and plaster a considerable distance from the rough wall, in order that the leaves of a shutter may be as few as possible, and not troublesome to shut, as would be the case were this rule not adopted.

Brace. A piece of timber framed in with bevel joints; serving to keep the building from swerving either way. See *Truss and Angle Braces.*

Bracket. A support for shelves, &c. When small shelves are to be supported, the bracket is generally made of a solid piece of wood in the form of an ogee; but when the shelves are of large dimensions, the brackets are small trusses, consisting of a horizontal piece, a vertical piece, and a strut. Brackets are sometimes used under the ends of the wooden steps of stair-cases, next to the well-hole, for ornament only.

Bracketting. See *Joinery.*

Brads. A slender kind of nail, used in joinery, having no spreading head as other nails have, but a small projection on one side. Of these some are called *joiner's-brads* and are for hard wainscots; others *batten-brads*, for soft wainscots; and some *bill-brads* or *quarter-brads*, used when a floor is laid in haste, &c. When brads are used, it is customary to drive them beneath the surface of the wood with a punch and hammer, and to fill up the hole with putty, that the nailing may not be visible.

Bramante, Lazzari, D'Urbino. A celebrated architect, was born, according to some at Castel Durante, and according to others at Femaghano, in the province of Urbino, in the year 1544. The parents of Bramante, who were poor, beheld with pleasure their child's talent for design, and placed him in a school for painting, kept by Fra Bartalomeo of Urbino, where he made rapid progress; but his taste and talents for architecture, outran every other consideration, and he eventually applied himself solely to it. Led by his genius for architecture, he visited Milan. The superb dome of the cathedral in that metropolis, made a strong impression upon his mind; and he studied the principles of the art under the best masters he could procure. He afterwards went to Rome, where, and at other towns in Italy, he carefully examined the architectural remains of antiquity. At Naples he was employed by cardinal Caraffa in rebuilding the convent Della Place; and the reputation he acquired by this work gained him the protection of pope Alexander VI., for whom he executed several considerable designs. Julius II. made him superintendant of his buildings. It was under this pontiff, that Bramante conceived the noble project of connecting the Belvedere palace with the Vatican, by means of two grand galleries carried across a valley. The impatient character of the pope was gratified by the amazing celerity with which his architect brought his plans into effect; often, however, at the expense of their durability, so that many of his new buildings required early repair. Bramante accompanied pope Julius to Bologna in 1504, where he was employed to fortify the town; and during the war of Mirandola he gave several proofs of his knowledge of the military art. Returning to Rome he embellished that city with a variety of fine buildings, which led the way to the mighty work which has principally immortalized his name. This was the cathedral of St. Peter's, which, at his persuasion, pope Julius substituted for the ancient church of that name, with the express intention of making an edifice worthy of the capital of Christendom.

Bramante gave several designs for this structure, one of which being adopted, the work was commenced with great ardour, and an indelicate precipitation was shown in demolishing the ancient church, with its tombs and fine monuments. Before the death of the pope, in 1513, the building was advanced to the entablature, and the four great arches for the support of the dome were erected at the time of the death of Bramante, in 1514. This was the only part of his workmanship left standing by the architects who succeeded him, and who almost entirely deviated from the original design, to the injury as has been thought to the structure. Michael Angelo Bonarrotti, (see *Bonarrotti*) who at length obtained the superintendence of this building, gave liberal praises to his plan, and affected as much as possible to return to his ideas.

Bramante was much honoured during life, and lamented at his death. His character was gentle and obliging. He was fond of encouraging young artists; and he invited to Rome the great Raphael, who was his cousin, whom he instructed in architecture, and caused to be employed in the Vatican. He cultivated poetry with success, and sometimes composed extemporaneously to his harp. The style of his first performances in architecture partook of the dryness of his age, but his imagination opened as he advanced. He has been accused of making a variety of faults through precipitation, and through his practice of beginning works before he had taken time to combine and perfect his ideas. He was the inventor of a manner of constructing arches by casting in wooden moulds a mixture of lime, marble-dust, and water, supposed to be a renovation of the stucco of the ancients. His poetical works were printed in Milan, in 1756.

Branches of arches. Several portions of arches springing from the same summer.

Branches of argives. The reins or arches of gothic vaults; which traversing from one angle to another, diagonal-wise, form a cross between the other arches which make the sides of the square, whereof those arches are diagonals.

Branches of vaults. A term sometimes used to denote the arches of vaults.

Brandrith. A fence round the mouth of a well.

Bray, Sir Reginald. An English politician and ingenious architect of the fifteenth century, was the second son of sir Richard Bray, one of the privy council to king Henry VI., and descended from an ancient family who accompanied William the conqueror into England, and flourished in the counties of Northampton and Warwick. He took an active part in the measures which seated the earl of Richmond on the throne, and was liberally rewarded by that monarch with honours and estates: and he was, says Thomas, in his "History of Malvern," in prosperity and adversity always faithful to his king. He was a knight banneret, and of the garter, chancellor of the duchy of Lancaster, high-steward of Oxford, &c. &c. Such were his abilities, and such was the king's opinion of him, that he was taken into his most intimate councils, and enjoyed an uninterrupted favour for seventeen years, to the time of his death. The character given of him by historians is, "that he was the very father of his country, a sage and grave person, a fervent lover of justice, and one who would admonish the king, if he did any thing contrary to right." That the chapel of St. George, at Windsor, owes much to the skill, as well as to the munificence of sir Reginald, there can be no doubt. His arms, sometimes single, sometimes impaling those of Huse, whom he married, and his device of a flax-breaker, are in so many parts of the ceiling and windows, that they could not have been placed there without a more than ordinary claim to the situation. The chapel on the south side, still called "Bray's chapel," was built by him to receive his body, as appears by his will, which is dated August 4, 1503, and he thereby directs that his body shall be buried in the chapel on the south side of the church of our Lady and St. George, in the castle of Windsor, which had been new made for that intent, and also in honour of Almighty God, &c. He wills that his executors, after his decease, should, with his goods and the issues and profits of his lands, make and perform the *new works* of the body of the said church, and thoroughly finish them, according to the form and intent of the foundation, in stonework, timber, lead, iron, and glass, and all other things necessary; that they should cause a *tomb* to be made for him in the said chapel: and he gave forty marks a year to the dean and canons, to distribute thirteen-pence every day to thirteen poor men or women at the door of the said chapel. He died the next day, and in the November following, his will was proved in the prerogative court of Canterbury. No tomb was erected, but his body probably lies under the stone which is placed over Dr. Waterland. From the expressions in the will as to finishing this church, it may fairly be inferred, not only that great works had there been carried on at his expense, but that he had a share, at least, in the designing them. After seeing what he did here, it may not, perhaps, be too much to conjecture that he had also a share in the design of Henry the seventh's chapel at Westminster, where he assisted in laying the first stone. As sir Reginald died without issue, he bequeathed the bulk of his fortune to Edmund, the eldest son of his younger brother John, who was summoned to parliament in 1530, as baron of Eaton Bray; and he also left considerable estates to Edmund and Reginald, younger brothers of Edmund.

Brazing. The soldering or joining of two pieces of iron by means of thin plates of brass, melted between the two pieces to be joined. If the work be very fine, as when the two leaves of broken saws are to be joined, it is to be covered with beaten borax, moistened with water, that it may incorporate with the brass-dust, which is here added; and the piece is exposed to the fire, without touching the coals, till the brass be observed to run. To braze with a still greater degree of nicety, they use a solder made of brass, with a tenth part of tin; or another one-third brass, and two-thirds silver; or borax and resin; observing in all these ways of brazing, that the pieces be joined close throughout; the solder only holding in those places that touch.

Breadth. The measure of any plane superficies from side to side, at right angles to the length.

Break. A projecting part of the front of grand buildings. See *Building*.

Break. A recess, or giving back of a part behind its ordinary range or projecture. In this sense we say, a break of pediment, a break of entablatures, whereby it shrinks, as it were, between the columns.

Break-in. To cut or break a hole in the brickwork with a ripping chisel for the insertion of a plug, or the end of a beam, &c.

Break-joint. One stone placed on the joint of two stones in the course below, to bind the work together.

Breast of a chimney. See *Chimney*.

Breast of a window. The masonry or brickwork forming the back of the recess and the parapet under the window cill.

Breeze. Small ashes and cinders made use of instead of coals, for the burning of bricks.

Bressummer, breast-summer, or brest-summer. A lintel beam in the exterior wall of a building, principally used over shop-windows, to sustain the superincumbent part of the wall. Bressummers are most commonly supported by iron or wooden posts, though sometimes pillars of brick or stone are used for the purpose. In the inner parts of a building, the pieces into which the girders are framed are called summers. See *Summer*.

Brewhouse. An apartment or building for the preparation of malt liquors.

Brick. A kind of factitious stone, composed of an argillaceous earth tempered and formed in moulds, dried in the sun, and finally burnt to a proper degree of hardness in a clamp or kiln.

The use of bricks is of the highest antiquity; and both burned and unburned bricks were used by the ancient Greeks and Romans. The method of making unburnt bricks is thus described by Vitruvius. "They should not be made of sandy, stony, or gravelly loam; for such kinds of earth, in the first place, render them heavy; and in the second place, upon being wetted with rain, after they are laid in the wall, they swell and dissolve, and the straw which is put in them does not adhere, on account of their roughness. Bricks should be made of earth that is white and chalky, or red, or having a masculine large sand; for these kinds being light and strong, are not weighty in working, and are laid with facility. They should also be made in the spring or autumn, as being the best time of drying; for those made in the summer are not so sound, on account of the intense heat of the sun, which parches the outside before the inside is sufficiently dry; which afterwards drying in the building, causes them to shrink and break others which were dry, by that means rendering the structure infirm, and full of fractures. They are best when made two years before they are used; for they cannot be sufficiently dry in less time. If they be used when newly made, and moist, the plaster work which is laid on them remaining firm and stiff, and they shrinking, and consequently not preserving the same height with the incrustation, it is by such contraction loosened and separated, by this means the plastering breaks, and falls from the building; for, on account of its thinness, it cannot stand of itself; and the walls themselves are sometimes damaged thereby. At Utica, therefore, the laws allow no bricks to be used before they have lain to dry five years, as must be proved to the magistrates, by whose authority they may then be used for the building of walls.

"There are three sorts of bricks; one of which the Greeks call *didoron*, which are such as we use, they are a foot long and half a foot broad. The other two sorts are used in the buildings of the Greeks, one of which they call *pentadoron*, and the other *tetradoron*; for the Greeks call the palm *doron*, because a gift which is always presented with the palm of the hand is, in Greek, called *doron*: those bricks, therefore, which have on every side five palms are called *pentadoron*, and those which have four *tetradoron*; in public works they use the former, and in private works the latter. Of these bricks they also make half-bricks; and in working, the whole bricks are placed in one course, and the half-bricks in the other: so that when both parts are built to a level, they appear to be laid in the walls with alternate faces outward, the middle of the bricks being disposed perpendicularly over the joints, giving strength, and not an unhandsome appearance, to both parts. At Calentum, in the farther Spain, at Marseilles in Gaul, and at Pitome in Asia, there are bricks which when made and dried will swim, if thrown into the water. The reason that they swim is, because the earth of which they are made is pumicosius, and replete with air, not relieving or imbibing the water; being therefore light and porous, and not suffering the water to penetrate into its substance. The Calentines have therefore a great advantage; for these bricks are not weighty in the building, and, when once made, cannot be impaired by the weather."

In the above description, Vitruvius does not mention the thickness of the bricks; the reader, therefore, should be apprized that, from some remains of bricks, it appears, the ancients made their bricks very thin, almost like tiles. The bricks tetradoron and pentadoron, used by the Greeks, were square, having, as Vitruvius states, every side equal, each side of the former measuring four palms, and of the latter five palms. The didoron bricks which the Romans used were oblong, being a foot long, and half a foot broad; that is four palms long and two broad, which is exactly equal to half a tetradoron thick. As the Greeks made half-bricks of each of the sort that they used, the half tetradoron bricks of the Greeks were exactly similar to the didoron bricks of the Romans, and might be laid in the same manner, and make just the same appearance in the work.

Barbaro, Alberti, and some others, have supposed that these half-bricks were made by dividing the whole brick diagonally, so that they become triangular; of which kind some are still to be seen in the remains of the walls of Rome, in that part particularly which was built by the emperor Aurelian. But Newton, in his translation of Vitruvius, states, that Vitruvius does not mean that triangular sort, but a quadrangular kind, made by dividing the whole brick quadrilaterally; for he speaks of their appearing to be laid in the wall with alternate faces outward, thereby implying that the faces were of different dimensions, which is not the case of the two sides of such triangular bricks. The diagonal side is indeed of a different dimension from the other two; but it cannot be supposed, that Vitruvius means that side to be used alternately with the others; its measure being so disproportionate and incongruous to the square sides, that they can never be made to agree together in any regular order. M. Quatremere de Quincy, in the "Encyclopedie Methodique," observes, that in his researches among the antique buildings of Rome, he has found bricks of three sizes. The least were 7 inches and a half square, and 1 inch and a half thick; the medium ones 16 inches and a half square, and from eighteen to twenty lines in thickness; and the larger ones 22 inches square, by twenty-one or twenty-two lines thick. The smaller bricks were employed to face walls of rubble-work; and, to make a better bond with the wall, they were cut diagonally into two triangles; the longer side was placed on the outside, and the point towards the interior of the work. To tie more effectually the facing with the rubble, they placed at every 4 feet in height one or two courses of the large square bricks. The large bricks were also used in the arches of openings or discharge, which were necessary in the building.

In modern times, bricks have been used in all countries. Chardin thus describes the manufacture of bricks in Persia. The material of Persian buildings is bricks, either dried in the sun, or burnt in the fire. The tiles or bricks of earth are made in thin wooden moulds, 8 inches long, 6 wide, and 2½ inches thick. The labourers temper with their feet the earth, which is generally mixed with straw cut very small, to give it more consistence, and that the bricks may last longer and not break. They pass the hands over the bricks to smooth them, after having dipped them in a vessel of water mixed with straw, still finer than was at first used. Then, taking off the moulds, they leave the bricks to dry for two or three hours, after which they are ranged over one another, where they remain till the drying is completed. The baked bricks are made of two parts of earth and one of cinders well-tempered together, in moulds larger than for the others. They leave them to dry in the sun for several days, then place them in a large furnace, ranged one over the other, at some distance, which they fill with plaster. They close the furnace and light the fire, which is kept up for three days and nights.

In England, the earth best adapted for the manufacture of brick is of a clayey loam, neither containing too much argillaceous matter, which causes it to shrink in the drying, nor too much sand, which has a tendency to render the ware both heavy and brittle. It should be dug two or three years before it is wrought, that it may, by an exposure to the action of the atmosphere, lose the extraneous matter of which it is possessed when first drawn from its bed; or, at least, should be allowed to remain one winter, that the frost may mellow and pulverize it sufficiently to facilitate the operation of tempering. As the quality of the brick is greatly dependant upon the tempering of the clay, great care should be taken to have this part of the process well done. Formerly the manner of performing it consisted in throwing the clay into shallow pits, and subjecting it to the tread of men and oxen; but this method has of late been superseded by the clay or pug mill, for which, see the respective articles.

When the clay has been sufficiently tempered by either of the above modes, it is taken to the moulder's bench, and is, either by a lad or a woman, cut into pieces somewhat larger than the mould, and passed on to the moulder; who throws it smartly into a mould, which has been previously dipped in sand, then presses it down to fill all the cavity, and strikes off the overplus with a flat smooth piece of wood. He then turns the newly formed brick from the mould on to a thin board, somewhat larger than the brick, which is removed by a boy to a light latticed wheelbarrow, and is thus conveyed, covered slightly with fine dry sand, to the hack.

In the hack, the bricks are arranged somewhat diagonally one above the other, and two edgewise across, with a passage between each for the admission of air, till they be eight bricks in height. They are then left to dry. The time they take ere they require shifting depends entirely upon the weather, which, when fine, will be but a few days: they are then turned, and reset wider apart, and in six or eight days are ready for the clamp or kiln.

In showery weather, care should be taken to cover the bricks in the hack with wheat or rye straw, to keep them dry: and, as it is of consequence that the bricks should be thoroughly dried before they are set in the clamp or kiln, a few bricks should be selected from various parts of the hack and broken in half, in order to ascertain whether the operation of drying has been properly performed; for, if this be not attended to, the moisture ascending from them, in the form of vapour, will render the bricks very unsound.

In the vicinity of London, bricks are generally burned in clamps, which are of an oblong form. The foundation is made either with the driest of the bricks just made, or with the commonest kind of bricks, called place bricks. The bricks to be burnt are arranged tier upon tier, as high as the clamp is intended to be, and a stratum of breeze or cinders, to the depth of 2 or 3 inches, is strewed between each layer of bricks, and the whole is finally covered with a thick stratum of breeze. At the west end of the clamp, a perpendicular fireplace, about 3 feet in height, is constructed, and flues are formed by arching the bricks over so as to leave a space of about a brick in width. The flues run straight through the clamp, and are filled with a mixture of coals, wood, and breeze, which are pressed closely together. If the bricks are required to be burnt off quickly, (which can be accomplished in the space of from twenty to thirty days, according to the state of the weather,) the flues must not exceed 6 feet distance apart; but if there is no urgent demand, the flues need not be nearer than 9 feet, and the clamp may be allowed to burn slowly.

Kilns are also used: in these, twenty thousand bricks can be burned at a time. The walls of a kiln are about a brick and a half thick, and incline inwards towards the top, so that the area of the upper part is not more than 114 square feet. The bricks are set on flat arches, with holes left between them, resembling lattice-work; and when the kiln is completed, they are covered with pieces of broken bricks and tiles, and some wood is put in and kindled, to dry them gradually. When sufficiently dried, which is known by the smoke changing from a dark to a light transparent colour, the mouths of the kiln are stopped with pieces of brick, called *shinlog*, piled one upon another, and closed over with wet brick earth. The shinlogs are carried so high as just to leave room for one faggot to be thrust into the kiln at a time; and when the brush-wood, furze, heath, faggots, &c. are put in, the fire is kindled, and the burning of the kiln commences. The fire is kept up till the arches assume a white appearance, and the flames appear through the top of the kiln; upon which the fire is allowed to slacken, and the kiln to cool by degrees. This process of alternately heating and slacking the kiln is continued till the bricks are thoroughly burnt, which is, in general, in the space of forty-eight hours.

The practice of steeping bricks in water after they have been burnt, and burning them again, has the effect of considerably improving the quality.

Bricks are of several kinds, the most usual of which are malm-stocks, and place bricks; but there is little difference in the mode of manufacturing them, except that great care is taken in preparing and tempering the first mentioned.

As marl is not always to be found where malm-stock bricks are required, the mode of manufacture as adopted by Mr. Lee, of Lewisham, is well worth the attention of builders, who may wish to manufacture these beautiful bricks without marl. After many experiments, occasioned by the paucity of marl in the London districts, Mr. Lee discovered that chalk, mixed in certain proportions with loam, and treated in the usual manner, produced an excellent substitute. For this discovery he took out a patent, which having now expired, his mode of mixing a small quantity of chalk with the brick earth, is generally adopted round London, for the purpose of giving colour and soundness to the brick. At Emsworth, in Hampshire, and at Southampton, ooze, or sludge from the sea-shore, which contains much saline matter, is used for a similar purpose; but however sound those bricks are, they have neither the rich brimstone colour of the London malm-stock, nor the regular stone-coloured creamy hue of the Ipswich bricks.

The finest marls, called *firsts*, are selected for the arches of doorways, &c., and are rubbed to their proper form and dimensions: and the next best, called *seconds*, for the principal fronts. The colour, a light yellow, added to the smooth texture and superior durability of the marls, give them the precedence of the other descriptions of brick.

Grey stocks are somewhat like the seconds; but are of inferior quality,

Place bricks, sometimes called

sandal, pickings, or samel bricks, are soft, of uneven texture, and of a red colour, arising from their being the outermost in the clamp or kiln, and not having been sufficiently burned.

Burrs and clinkers are such bricks as have been violently burned; and sometimes several bricks are found run together, or united in the kiln.

The red bricks derive their colour from the nature of the soil, of which they are composed, and which in general is very pure. The best are used for cutting bricks, and are called red rubbers. In old buildings they are very frequently to be seen set in putty, and used as ornaments over arches, windows, doorways, &c.

Fire-bricks are made at the village of Hedgerly, near Windsor, at Stourbridge, at Nonsuch, and in various parts of Wales. These last are called *Welsh lumps.*

In some experiments made by Mr. Adcock, to ascertain the comparative value of west and north country coals, a very curious fact was elicited relative to the Stourbridge and Nonsuch bricks, which is well worthy the attention of all connected with the construction of furnaces.

By those experiments it appears, that the Nonsuch bricks will not resist the action of fire of the Staffordshire coal so well as the bricks made at Stourbridge; but that the best of the Nonsuch bricks will resist the action of the fire of the north country coal much better than those made at the latter place. By this, therefore, it appears, that in the erection of furnaces, where the Staffordshire coal is to be used, the Stourbridge bricks should be employed; but in erecting such furnaces as are to consume the north country coal, as, for example, those near London, where the excessive duty on the Staffordshire coal amounts to a prohibition of its use, preference should be given to the Nonsuch.

These experiments were tried in a reverberatory welding furnace, having a stack (chimney) 40 feet high; and the utility of the Nonsuch for these purposes has been proved by a trial of several years.

Besides the bricks above enumerated, there are paving-bricks, which are generally about 1½ inch in breadth; and paving-tiles, which are made of a stronger clay, and are of a red colour. The largest are about 12 inches square, and 1½ inch thick: the next, though called 10-inch tiles, are about 9 inches square, and 1¼ inch thick.

About the year 1795, Mr. Cartwright obtained a patent for an improved system of making bricks, of which the following extract will furnish the reader with every necessary information:—

"Imagine a common brick, with a groove or rabate on each side down the middle, rather more than half the width of the side of the brick; a shoulder will thus be left on either side of the groove, each of which will be nearly equal to one quarter of the width of the side of the brick, or to one-half of the groove or rabate. A course of these bricks being laid shoulder to shoulder, they will form an indented line of nearly equal divisions, the grooves or rabates being somewhat wider than the adjoining shoulders, to allow for the mortar or cement. When the course is laid on, the shoulders of the bricks, which compose it, will fall into grooves of the first course, and the shoulders of the first course will fit into the grooves or rabates of the second; and so with every succeeding course. Buildings constructed with this kind of brick will require no bond timbers, as a universal bond runs through the whole building, and holds all the parts together, the walls of which will neither crack nor bilge without breaking through themselves. When bricks of this construction are used for arches, the sides of the grooves should form the radii of the circle, of which the intended arch is a segment; yet if the circle be very large, the difference of the width at the top and bottom will be very trifling, as to render a minute attention to this scarcely, if at all, necessary. In archwork, the bricks may either be laid in mortar, or dry, and the interstices afterwards filled up by pouring in lime, putty, plaster of Paris, &c. Arches upon this principle, having any lateral pressure, can neither expand at the foot, nor spring at the crown; consequently they want no abutments, requiring only perpendicular walls to be let into, or to rest upon; neither will they want any superincumbent weight on the crown to prevent their springing up. The centres may also be struck immediately, so that the same centre, which never need be many feet wide, may be regularly shifted as the work proceeds. But the most striking advantage attending this invention is, the security it affords against the ravages of fire; for, from the peculiar properties of this kind of arch, requiring no abutments, it may be laid upon, or let into common walls, no stronger than what is required for timbers so as to admit of brick floorings."

Bricks are subject to a duty; and the first rise of materials commenced in 1784, when the first duties were laid on bricks and tiles, and additional duties on timber and deals. The duties on bricks and tiles have been twice augmented since that time. The first duties laid on, as extracted from the act, were as follow, and were to be paid by the maker. For and upon all bricks, by whatsoever name or names they now are, or hereafter may be called or known, a duty of two shillings and sixpence for every thousand; and so in proportion for any greater or less quantity.

For and upon all tiles, commonly called or known by the name of plain tiles, a duty of three shillings for every thousand; and so in proportion for any greater or less quantity.

For and upon all tiles, commonly called or known by the name of pan or ridge-tiles, a duty of eight shillings for every thousand; and so in proportion for any greater or less quantity.

For and upon all tiles, commonly called or known by the name of paving-tiles, not exceeding 10 inches square, a duty of one shilling and sixpence for every hundred; and so in proportion for any greater or less quantity.

For and upon all tiles, commonly called or known by the name of paving-tiles, exceeding 10 inches square, a duty of three shillings for every hundred; and so in proportion for any greater or less quantity.

For and upon all tiles, other than such as are herein-before enumerated and described, by whatever name or names such tiles now are, or hereafter may be called or known, a duty of three shillings for every thousand; and so in proportion for any greater or less quantity,

The next duty, being additional, took place in March, 1794, on bricks and tiles, and is extracted from the act, as follows:—

For every thousand of bricks, which shall be made in Great Britain, and so in proportion for any greater or less quantity, one shilling and sixpence; making together with the former duty of two shillings and sixpence, four shillings per thousand.

For every thousand of plain tiles, which shall be made in Great Britain, and so in proportion for any greater or less quantity, one shilling and tenpence; making, together with the former duty of three shillings, four shillings and tenpence per thousand.

For every thousand of pantiles, or ridge-tiles, which shall be made in Great Britain, and so in proportion for any greater or less quantity, four shillings and tenpence; making with the former duty of eight shillings, twelve shillings and tenpence per thousand.

For every hundred of paving tiles, which shall be made in Great Britain, not exceeding 10 inches square, and so in proportion for any greater or less quantity, eleven-pence; making together with the former duty of one shilling and sixpence, two shillings and fivepence per hundred.

For every hundred of paving-tiles which shall be made in Great Britain, exceeding 10 inches square, and so in proportion for any greater or less quantity, one shilling and tenpence; making together with the former duty of three shillings, four shillings and tenpence per hundred.

For every thousand of tiles which shall be made in Great Britain, other than such as are herein-before enumerated or described, by whatsoever name or names such tiles are, or may be called or known, and so in proportion for any greater or less quantity, one shilling and tenpence; making together with the former duty of three shillings, four shillings and tenpence per thousand.

The said duties on bricks and tiles respectively to be paid by the maker thereof.

And in May, 1794, a duty of twenty per cent *ad valorem*, was laid on all stone for building, coming coastways.

And by an act passed the 4th day of July, 1803, to consolidate the duties of excise in Great Britain, certain additions were laid on bricks, leaving the duties on tiles as before. The whole of which duties are as follows:—

For every thousand of bricks made in Great Britain, not exceeding 10 inches long, 3 inches thick, and 5 inches wide, five shillings. Exceeding the foregoing dimensions, ten shillings.

For every thousand of bricks made in great Britain, and smoothed or polished on one or more sides, not exceeding the superficial dimensions of 10 inches long, by 5 inches wide, twelve shillings.

For every hundred of such last mentioned bricks, exceeding the aforesaid superficial dimensions, the duties the same as on paving-tiles.

For every thousand of plain tiles, four shillings and tenpence.

For every hundred of paving-tiles, not exceeding 10 inches square, two shillings and fivepence.

For every hundred of paving-tiles, exceeding 10 inches square, four shillings and tenpence.

For every thousand of tiles, other than such as are herein-before enumerated, four shillings and tenpence.

The said duties to be paid by the makers.

In June, 1804, an additional duty

was laid of twelve per cent, on all stone for building, coming coastways.

An act for granting to his majesty additional duties within Great Britain, on certain goods, wares, and merchandize, imported into, or carried coastwise, 5th of April, 1805.

For every hundred pounds of the produce, and amount of duties of customs due and payable on slate and stone of all sorts, an additional duty of twenty pounds.

N. B. Three shillings per thousand extra were laid on all kinds of bricks by the brickmakers, 1st of January, 1805, although no act of parliament for advance had passed; but an act passed in March, 1805, laying a further duty on bricks and tiles of tenpence per thousand, which makes an advance in general on all brickwork, with the above three shillings, of eighteen shillings per rod prime cost.

Brick-kiln. A kiln in the form of a frustum of a cone, in which bricks are burnt. See *Brick*.

Bricklayer. A workman who builds with bricks. The bricklayers in London are, by a charter, granted in 1568, a corporate company, consisting of a master, two wardens, twenty assistants, and seventy-eight on the livery.

As the building act relates more particularly to bricklayers, than to any other class of artificers connected with building, we shall in this place, present the reader with an abstract of it. By this act, passed in the 14 Geo. III., all buildings within the cities of London and Westminster, the liberties thereof, the bills of mortality, the parishes of St. Mary-la-bonne, Paddington, St. Pancras, and St. Luke at Chelsea, in the county of Middlesex, are divided into seven several rates or classes, and such several rates or classes of buildings are under the following rules and regulations.

First rate building.—Every church, chapel, meeting-house, and other place of public worship; and every house or building for distilling and brewing of liquors for sale; for making of soap, for melting of tallow, for dyeing, for boiling or distilling turpentine, for casting brass or iron, for refining of sugar, for making of glass for chemical works for sale, of what dimension soever the same respectively are or may be; and also every warehouse and other building whatsoever, not being a dwelling-house now built, or hereafter to be built, (except such buildings as are herein-after particularly declared to be of the fifth, sixth, or seventh rate or class of building,) which does or shall exceed three clear stories above ground, exclusive of the rooms (if any) in the roof thereof, or which is or shall be of the height of 31 feet from the surface of the pavement, ground, or way, above the area before either of the fronts thereof, to the top of the blocking-course or the coping on the parapet thereof; and every dwelling-house, now built, or hereafter to be built, which, with the offices thereto belonging and adjoining, or connected otherwise than by a fence or fence-wall, or covered passage open on one or both sides, when finished, does or shall exceed the value of eight hundred and fifty pounds; and also every dwelling-house, which does or shall exceed nine squares of building on the ground-floor, each square containing 100 superficial feet, shall be deemed the first rate or class of building; and must be built as follows, viz.

The thickness of external walls, not being a party-wall to any first rate building, or to any addition or enlargement, shall be built and remain, at the foundation thereof, of the thickness of two bricks and a half in length, or 1 foot 9½ inches at the least; and shall from thence regularly and gradually diminish on each side of the wall 2¼ inches to the top of the footing of every such wall, except where any immediate adjoining building will not admit of such footing being made on the side of such wall next such adjoining building; in which case such footing shall be made as near to the dimensions herein directed as the case will admit; which footing shall be 9 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story, 2 inches at the least; and every such wall shall, from the top of such footing, be of the thickness of two bricks in length, or 1 foot 5½ inches at the least, up to the under side of the one pair of stairs' floor; and from thence of the thickness of one brick and a half in length, or 13 inches at the least, up to the under side of the plate under the roof or gutter of every such building; and from thence of the thickness of one brick in length, or 8½ inches at the least up to the under side of the blocking-course or coping on the parapet of every such first rate building; except such parts of every such wall as shall be wholly of stone, which parts, so being of stone, shall be of the thickness of 14 inches at the least below the ground-floor, and of 9 inches at the least above the ground-floor; and except all recesses above the ground-floor in the said walls, which shall be arched over in every story, so nevertheless as that the arch and the back of such recess shall be respectively of the thickness of one brick in length, or 8½ inches at the least.

The thickness of party-walls to any first rate building, or to any addition or enlargement shall be built and remain, at the foundation thereof, of the thickness of three bricks and a half in length, or 2 feet 6½ inches at the least; and shall, from thence, regularly and gradually diminish on each side of the wall 4½ inches to the top of the footing of every such wall, which footing shall be 1 foot high at the least, and wholly below the upper surface of the pavement and flooring boards of the cellar story 2 inches at the least; and every such party-wall shall, from the top of such footing, be of the thickness of two bricks and a half in length, or 1 foot 9½ inches at the least, up to the under side of the ground-floor; and from thence of the thickness of two bricks in length, or 1 foot 5½ inches at the least, up to the under side of the floor of the rooms (if any) in the roof of the highest building adjoining to such party-wall, and from thence of the thickness of one brick and a half in length, or 13 inches at the least, up to the top of every such party-wall.

Second rate building. Every warehouse, stable, and other building, not being a dwelling-house, except such buildings as are herein particularly declared to be of the first, fifth, sixth, or seventh rate or class of building, now built, or hereafter to be built, which does or shall exceed two clear stories, and shall not contain more than three clear stories above ground, exclusive of the rooms (if any) in the roof thereof, or which is, or shall be, of the height of 22 feet, and shall not be of the height of 31 feet from the surface of the pavement, ground, or way, above the area before either of the fronts thereof, to the top of the blocking-course or coping on the parapet thereof; and every dwelling-house now built, or hereafter to be built, which, with the offices thereto belonging and adjoining, or connected otherwise than by a fence or fence-wall, or covered passage open on one or both sides when finished, does or shall exceed the value of three hundred pounds, and shall not amount to more than the value of eight hundred and fifty pounds; and also every dwelling-house, which does or shall exceed five squares of building on the ground plan, and shall not amount to more than nine squares of building on the ground plan thereof, shall be deemed the second rate or class of building; and must be built as follows, viz.

The thickness of external walls, (not being a party-wall,) to any second rate building, or to any addition or enlargement, shall be built and remain, at the foundation thereof, of the thickness of two bricks in length, or 1 foot 5½ inches at the least, and shall from thence regularly and gradually diminish on each side of the wall 2¼ inches to the top of the footing of every such wall, except where any immediate adjoining building will not admit of such footing being made on the side of such wall next such adjoining building; in which case such footing shall be made as near to the dimensions herein directed as the case will admit; which footing shall be 9 inches high at the least; and wholly below the upper surface of the pavement and flooring-boards of the cellar story 2 inches at the least; and every such wall shall, from the top of such footing, be of the thickness of one brick and a half in length, or 13 inches at the least up to the under side of the one pair of stairs floor; and from thence of the thickness of one brick in length, or 8½ inches at the least, up to the under side of the blocking-course or the coping on the parapet of every such second rate building; except such parts of every such wall, being above the ground-floor, as shall be wholly of stone, which parts, so being of stone, shall be of the thickness of 9 inches at the least, and except all recesses above the ground-floor in the said walls, which shall be arched over, so nevertheless as that the arch, and the back of each such recess, shall respectively be of the thickness of one brick in length, or 8½ inches at the least.

The thickness of party-walls to any second rate building, or to any addition or enlargement, shall be built and remain, at the foundation thereof, of the thickness of three bricks and a half in length, or 2 feet 6½ inches at the least, and shall from thence regularly and gradually diminish on each side of the wall 4½ inches to the top of the footing of every such wall; which footing shall be 9 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story 2 inches at the least, and every such party-wall shall, from the top of such footing, be of the thickness of two bricks and a half in length, or 1 foot 9½ inches at the least, up to the under side of the ground-floor; and from thence of the thickness of two bricks in length, or 1 foot 5½ inches at the least, up to the under side of the floor of the two pair of stairs story; and from thence of the thickness of one brick and a half in length, or 13 inches at the least, up to the top of every such party-wall.

Third rate building. Every warehouse, stable, and other building, not being a dwelling-house, except such buildings as are herein particularly declared to be of the first, fifth, sixth, or seventh rate or class of building, now built, or hereafter to be built, which does or shall exceed one clear story, and shall not contain more than two clear stories above ground, exclusive of the rooms (if any) in the roof thereof, or which is or shall be of the height of more than 13 feet, and shall not be of the height of 22 feet from the surface of the pavement, ground, or way above the area before either of the fronts thereof, to the top of the blocking-course or the coping on the parapet thereof; and every dwelling-house now built, or hereafter to be built, which, with the offices thereto belonging, and adjoining or connected, otherwise than by a fence or fence-wall, or covered passage open on one or both sides, when finished, does or shall exceed the value of one hundred and fifty pounds, and shall not amount to more than the value of three hundred pounds; and also every dwelling-house, which does or shall exceed three squares and a half of building on the ground plan, and shall not amount to more than five squares of building on the ground plan thereof, shall be deemed the third rate or class of building, and must be built as follows, viz.

The thickness of external walls, (not being a party-wall) to any third rate building, or to any addition or enlargement, shall be built and remain, at the foundation thereof, of the thickness of two bricks in length, or 1 foot 5½ inches at the least, and shall from thence regularly and gradually diminish, on each side of the wall, 2¼ inches, to the top of the footing of every such wall, except where any immediate adjoining building will not admit of such footing being made on the side of such wall next such adjoining building; in which case such footing shall be made as near to the dimensions herein directed as the case will admit; which footing shall be 6 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story 2 inches at the least, and every such wall shall, from the top of such footing, be of the thickness of one brick and a half in length, or 13 inches at the least, up to the under side of the ground-floor; and from thence of the thickness of one brick in length, or 8¾ inches at the least, up to the under side of the blocking course or coping, on the parapet of every such third rate building.

The thickness of party walls, to any third rate building, or to any addition or enlargement, shall be built and remain, at the foundation thereof, of the thickness of three bricks in length, or 2 feet 2 inches at the least, and shall from thence regularly and gradually diminish on each side of the wall, 4½ inches to the top of the footing of every such wall, which footing shall be 9 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story, 2 inches at the least; and every such party-wall shall, from the top of such footing, be of the thickness of two bricks in length, or 1 foot 5½ inches at the least, up to the under side of the ground-floor; and from thence of the thickness of one brick and a half in length, or 13 inches at the least, up to the top of every such party-wall.

Fourth rate building. Every

warehouse, stable, and other building not being a dwelling-house, except such buildings as are herein particularly declared to be of the first, fifth, sixth, or seventh rate or class of building, now built, or hereafter to be built, which does not or shall not exceed one clear story above ground, exclusive of the rooms (if any) in the roof thereof, or which is not or shall not be of the height of more than 13 feet from the surface of the pavement, ground, or way, above the area before either of the fronts thereof to the top of the blocking-course or coping on the parapet thereof; and every dwelling-house now built, or hereafter to be built, which, with the offices thereto belonging and adjoining, or connected otherwise than by a fence or fence-wall, or covered passage open on one or both sides, when finished, does not, or shall not exceed the value of one hundred and fifty pounds; and also every dwelling-house which does not or shall not exceed three squares and a half of building on the ground plan thereof, shall be deemed to be of the fourth rate or class of building; and must be built as follows, viz.

The thickness of external walls to any fourth rate building, or to any addition or enlargement, shall be built and remain at the foundation thereof, of the thickness of two bricks in length, or 1 foot 5½ inches at the least, and shall from thence regularly and gradually diminish on each side of the wall 2¼ to the top of the footing of every such wall, except where any immediate adjoining building will not admit of such footing being made on the side of such wall next such adjoining building; in which case such footing shall be made as near to the dimensions herein directed as the case will admit, which footing shall be 6 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story 2 inches at the least; and every such wall shall, from the top of such footing, be of the thickness of one brick and a half in length, or 13 inches at the least, up to the under side of the ground-floor; and from thence of the thickness of one brick in length, or 8½ inches at the least, up to the under side of the blocking-course or coping on the parapet of every such fourth rate building.

The thickness of party-walls, to any fourth rate building, or to any addition or enlargement, shall be built and remain at the foundation thereof, of the thickness of two bricks in length, or 1 foot 5½ inches at the least; and shall from thence regularly and gradually diminish on each side of the wall 2¼ inches to the top of the footing of every such wall, which footing shall be 9 inches high at the least, and wholly below the upper surface of the pavement and flooring-boards of the cellar story 2 inches at the least; and every such party-wall shall, from the top of such footing, be of the thickness of one brick and a half in length, or 13 inches at the least, up to the under side of the ground-floor; and from thence of the thickness of one brick in length, or 8½ inches at the least up to the top of every such party-wall.

Further regulations of first, second, third, and fourth rate buildings. It is also further enacted, that every house or building of the first, second, third, or fourth rate or class of building herein-before directed, and not having each of them a separate and distinct side-wall on the part or parts where they are or shall be contiguous, shall have party-walls between house and house, or other buildings, or between so much of such house and house, or other buildings, as shall not respectively have such separate and distinct walls as aforesaid; and such party-walls shall extend to the outer surfaces of external enclosures of each of the adjoining houses or buildings: and all party-walls, and also all chimneys and chimney-shafts, hereafter to be built, shall be built wholly of good sound bricks or stone, or of good sound brick and stone together, except such timber, wood, lead, or iron work, as shall or may be laid therein, according to the directions herein-after contained, and also except such piling, bridging, or planking, as may be necessary for the foundation thereof; and every such party-wall shall be topped or coped with stone, tile, or brick, and shall be of the dimensions herein-before directed; and one-half of every such party-wall between house and house, or between other buildings, shall be built on the ground or site of one of the adjoining houses or buildings, and the other half thereof shall be built on the ground or site of the other of the adjoining houses or buildings; and it shall be lawful for the first builder of any such party-wall, and for the workmen employed in building the same, to enter upon the ground adjoining thereto, in order to the building such party-wall in manner aforesaid.

Provided, nevertheless, that every party-wall which shall be built to any dwelling-house, exceeding four stories in height from the foundation thereof, exclusive of the rooms (if any) in the roof of either of the buildings adjoining thereto, shall be built in every particular according to the directions herein-before contained with respect to the party-walls of the first rate or class of building, notwithstanding such house shall not be of the first rate or class of building; and every party-wall which shall, after the time aforesaid, be built to any dwelling-house containing four stories in height from the foundation thereof, exclusive of the rooms (if any) in the roof of either of the buildings adjoining thereto, shall be built in every particular according to the directions herein-before contained with respect to party-walls of the third rate or class of building, notwithstanding such house shall be of the fourth rate or class of building only.

And it is also further enacted, that every internal enclosure to be made, for separating any building of the first, second, third, or fourth rate or class of building, from any other building, where such buildings shall be in separate occupations, and every addition or enlargement to such internal enclosure, shall be of brick or stone, or artificial stone or stucco, or of brick and stone, or artificial stone or stucco together; except such timber, wood, lead, or iron work, as may be laid therein, according to the directions herein-after contained for external enclosures to such first, second, third, or fourth rate or class of building, and also except such piling, bridging, or planking, as may be necessary for the foundation of the same.

And it is also enacted, that in valuing the several buildings herein-before declared to be of the first, second, third, or fourth rate or class of building, for the purpose of ascertaining the rate thereof, such valuation to be made by the surveyor or surveyors, to be appointed pursuant to this act, for the district in which the building is or may be situated, by as true a measure and estimation as the nature of the case will admit; and every such building shall, notwithstanding any decay therein, be estimated and valued as if the materials whereof the same consists were sound, and the work new; and every such building shall be estimated and valued at the several prices the like materials and workmanship shall be worth at the time such valuation shall be made; but neither the soil whereon any such building stands, nor any fence or fence-wall, (except the railing to areas, and steps before or behind such building, made for the purpose of enclosing the said building, with the offices, yard, or appurtenances thereto belonging, from any neighbouring ground,) nor any brick or stone arched vault or vaults, under the surface of the ground, either before or behind such building, nor any lead, covering, or pavements over such vaults, nor such parts of the party-wall, or party-walls, to such building, as stand upon ground not belonging to such house shall be included in any such valuation; and in ascertaining the squares of building contained in every such building, being a dwelling-house, the same shall be taken by the surveyor or surveyors as aforesaid, on the level of the floor at the principal entrance to such dwelling-house, and no more than such parts of the party-walls as belong to such dwelling-house shall be included in such admeasurement; and in case the owner, or any other person interested in such building, shall apprehend him or herself to be injured by the admeasurement or valuation made by such surveyor or surveyors as aforesaid, it shall be lawful for such owner or other person to apply to the mayor, or any two justices of the peace for the city of London, if such building, or any part thereof, is situated within the said city, or otherwise to any two justices within whose jurisdiction the same is situated; and the said mayor or justices shall inquire into the matter, and shall, by his or their order, declare such building to be of such rate or class as the same shall to him or them appear to be of, according to the description of the several rates or classes herein-before contained; and it shall be lawful for any of the parties between whom such order shall be made to appeal to the justices of the peace at their general quarter sessions of the peace, whose order and determination shall be binding and conclusive to all parties.

Fifth rate of building. Every dwelling-house, warehouse, stable, and other building (except such buildings, not being dwelling-houses, as are herein-before particularly declared to be of the first, or seventh rate or class of building,) which is or shall be at the distance of 4 feet, and not 8 feet, from any public road, street, or causeway, and is or shall be detached from any other building not in the same possession therewith 16 feet at the least, and not 30 feet, or connected with any other building only by a fence or fence-wall, shall be deemed to be of the fifth rate or class of building, and shall and may be built of any dimensions whatever.

Sixth rate building. Every dwelling-house, warehouse, stable, and other building, (except such buildings, not being dwelling-houses, as are herein-before particularly declared to be of the first rate or class of building,) which is or shall be at the distance of 8 feet from any public road, street, or causeway, and is or shall be detached from any other building not in the same possession therewith at least 30 feet, or connected with any other building only by a fence or fence-wall, shall be deemed to be of the sixth rate or class of building, and shall and may be built of any dimensions, and with any materials whatever.

Seventh rate building. Every cranehouse now built, or hereafter to be built, on any wharf or quay, and every shamble, windmill, or watermill, and also every building which is or shall be situated without the cities of London and Westminster, and the liberties thereof, used for workshops or drying-places for tanners, fellmongers, glue-makers, size-makers, calico-printers, whisters, whiting-makers, curriers, leather dressers, buckram-stiffeners, oilcloth painters, wool-staplers, throwsters, parchment-makers, and paper-makers, so long and at such times as they are or shall be used for some or one of those purposes and no longer, shall be deemed the seventh rate or class of building, and may be built of any dimensions whatever.

Every cranehouse, and every addition to, or enlargement thereof, shall be of stone, brick, slate, tile, oak, elm, steel, iron, or brass; but every other building of the seventh rate or class of building may be erected of any materials whatever. No cranehouse or other building of the seventh rate or class of building, or any external part thereof, shall be covered with pitch, tar, or any other inflammable composition or material whatever, nor shall be converted to any other use than as aforesaid.

And, in order to prevent doubts which may arise concerning the rate or class of building of any office or offices now built, or hereafter to be built, belonging to any building herein before declared to be of the first, second, third, or fourth rate or class of building, it is further enacted and declared, that every such office which shall be entirely free and detached from such building to which the same belongs, or shall be connected therewith only by a fence or fence-wall, or covered passage open on one or both sides, shall be deemed to be of the rate or class of building such office would be of, if the same did not appertain to any dwelling-house or other building.

Particulars relative to old party-walls. And whereas some houses or other buildings, erected previously to the passing of this act, may have one or more good sound party-wall or party-walls, although not built agreeably to the several rules herein-before directed, and in such case it may happen that one of the adjoining houses may have been, or may hereafter be built, without making use of such party-wall or party-walls: it is therefore enacted, that every such wall may remain as a party-wall, until both the houses or buildings to which the same belongs, shall be built (if such wall shall so long continue sound,) and that in case either of the houses or buildings to which any such party-wall does belong, has been, or shall hereafter be rebuilt with a wall against such party-wall, (without making use of such party-wall,) of the heights and thicknesses herein-before prescribed for side-walls, the proprietor of such remaining house or building shall not, when such remaining house or building, or when such old party-wall shall be taken down, be entitled to more than one-half of the materials of such old party-wall, nor to more than one-half of the ground on which such old party-wall was erected;

nor shall such proprietor build on more than one-half of the said ground, unless he shall have agreed with and satisfied the owner or owners of such adjoining rebuilt house, for the other half thereof; and in case the parties cannot agree concerning the same, and both or either of them shall be desirous of buying or selling, the price and the matters in difference, shall be settled by a jury; but if such remaining house or building be of the first, second, or third rate or class of building, or be four stories high from the foundation, exclusive of the rooms (if any) in the roof, and if in that case, such old party-wall shall not be of the thickness of two bricks in length, or 1 foot 5½ inches from the foundation to the under side of the ground-floor, and from thence upwards to the top, of the thickness of one brick and a half in length, or 13 inches, then such old party-wall shall, when either of the houses or buildings to which the same belongs be rebuilt, be considered as if the same had been condemned, or adjudged ruinous, pursuant to the directions herein-after contained for condemning or adjudging ruinous, any unsound party-wall; or if such old party-wall shall have any timber or timbers of any adjoining building lying through the same, and if, when either of the houses or buildings to which the same belongs, shall be rebuilt, the owner or owners of such adjoining or remaining house or building, will not permit so much of such timber to be cut off as shall leave full 6 inches of clear brickwork beyond the end of every such timber, then every such wall shall be considered as if the same had been condemned, or adjudged ruinous, pursuant to this act, and the same shall be taken down and rebuil in such manner as is herein-afte directed concerning party-wall which shall be so condemned, o adjudged ruinous.

And whereas some houses o other buildings erected previousl to the passing of this act, ma have one or more good and soun timber partition or timber partitions between the same and th adjoining house or building, it i further enacted, that every suc timber partition may remain unt one of the adjoining houses, o buildings to which the same belongs shall be rebuilt, or shal have one of the fronts which shal abutt on such timber partition, o two-third parts of one of suc fronts, taken down to the bressummer, or one pair of stairs floor and rebuilt; or until such timbe partition shall be condemned pursuant to the directions herein-after contained, concerning ruinous or defective party-walls and party-partitions.

External walls shall not become party-walls; and ever party-wall, addition or enlargement shall be carried up, an remain 1 foot 6 inches at th least above the roof of the highest building which shall gabl against such party-wall, in ever part where such building shal gable or adjoin thereto, measuring at a right angle with the back o the rafters of such roof; and ever such party-wall shall be carried up and remain 1 foot at the leas above the gutters of the highest o such buildings, except the height of such party-wall, where so carried up, shall exceed the height of the blocking-course or parapet of either of the fronts, abutting on the same of the highest building adjoining thereto; in which case, the end only of every such party-wall next such blocking-course or parapet may be less than 1 foot above the gutter, for the distance of 2 feet 6 inches from the front of such blocking-course or parapet; and in case any dormer or other erection is or shall be fixed in the flat or roof of any building within 4 feet of any party-wall, then every such party-wall shall be carried up against every such dormer or other erection, and shall extend for the breadth of at least 2 feet wider, and to the full height of every part of every such dormer or other erection as shall be within 4 feet of such party-wall.

No recess shall be made in any party-wall hereafter to be built to any building of the first, second, third, or fourth rate, or class of building, (except for chimneys, flues, girders, and beams, and other timbers, and for the ends of walls or piers, as herein-after is directed,) so as to reduce such wall in any part thereof under the thickness by this act required for the party-wall to the highest rate or class of building to which such party-wall belongs: and there shall not be any opening made in any party-wall, except for communication from one stack of warehouses to another, and from one stable building to another; all which communications shall have thereto iron doors, in such manner as is herein-after directed, also, except such passages or ways on the ground, for foot passengers, cattle, or carriages, as may be necessary; all which passages or ways shall be arched over with brick or stone, or brick and stone together throughout, of the thickness of 13 inches at the least, in every building of the first and second rate or class of building, and of the thickness of 8½ inches at the least, in every building of the third or fourth rate or class of building; and if there be any cellar, or vacuity, under any such passage, every such cellar or vacuity shall be arched over throughout with brick or stone, or brick and stone together, in the same manner as the passage or way over such cellar or vacuity is hereby directed to be arched.

And it is also further enacted, that no timbers shall be laid into any party-arch, except for bond to the same, nor into any party-wall, other than such templets, chains, and bond timbers, as shall be necessary for the same; and other than the ends of girders, beams, purlins, and of binding or trimming joists, or of other principal timbers; all which timbers shall have at least 8½ inches of solid brickwork between the ends and sides of every such piece of timber, and the timber of any building adjoining thereto: and the end of every girder, beam, purlin, binding or trimming joist, and of every other piece of principal timber, may be laid beyond the centre of any party-wall hereafter to be built, so nevertheless as that there be left 8½ inches at the least, of solid brick or stone work at the end of every such piece of timber, except in places where any part of the ends of any such timber shall lie opposite to, and level with, any part of the end of any timber of any adjoining building or buildings, in which case no part of such timbers shall approach nearer than 4 inches to the centre of the said wall.

And it is further enacted, that no person shall cut or maim any party-arch, nor the shaft of any chimney now built, or hereafter to be built, on any party-wall, for any purpose whatsoever; and that no person shall cut or maim any party-wall now built or hereafter to be built, other than for the purposes and in the manner herein-after mentioned; that is to say, when the front or back wall of any house or building, being in a line with the front or back wall of the house or building adjoining thereto, shall at any time hereafter be built, it shall be lawful to cut a break not more than 9 inches deep from the external face of such front or back wall and to the centre of such party-wall, for the purpose of inserting therein the end of such new front or back wall; and in every such case where a bressummer and story-post shall be fixed in the ground story of such new front or back wall, such break may be cut from the foundation of such new front or back wall, to the top of such bressummer, 14 inches deep from the external face of such front of back wall, and the same may be 4 inches wide in the cellar story, and 2 inches wide in the ground story, for the purpose of placing therein such story-posts and bressummers agreeably to the directions of this act: And it shall be lawful to cut into any party-wall for the purpose of tailing in stone steps, or stone landings, or for placing in such party-wall timber for bearers to wood stairs, so as no timber bearer be laid into any party-wall nearer than 8½ inches to any chimney or flue whatever, or to any timber of the adjoining house or building, or nearer than 4 inches to the internal finishing of such adjoining house or building, and for the purpose of laying therein stone corbels for the support of chimney jambs, girders, beams, purlins, binding or trimming joists, or of other principal timbers; and it shall also be lawful to cut perpendicular recesses into any party-wall, not being less than 13 inches thick, for the purpose of inserting walls and piers therein, so nevertheless as that no such recess be more than 15 inches wide, or more than 4 inches deep, and that no such recess be nearer than 10 feet to any other recess; and it shall be lawful to cut off the footing on the side of any party-wall where either of the adjoining buildings shall be rebuil with a wall against such party wall; but every person who shal cut into any party-wall for any o the purposes aforesaid, shall immediately make good, and well and effectually pin up with brick, stone, slate, tile, shell, or iron, bedded in mortar, every defect which shall be occasioned by the cutting of any such party-wall: and no party-wall shall be cut for any of the purposes aforesaid, if the cutting thereof will injure, displace, or endanger the timbers, chimneys, flues, or internal finishings of the adjoining buildings.

Chimneys in party-walls. The back of every chimney shall be at least 13 inches thick in the cellar story, and 8½ inches thick in every other story from the hearth of ever ysuch chimney to the height of 12 inches above the mantle, and no chimney in any party-wall, where either of the buildings adjoining thereto is of the first rate, or class of building, shall be built with the back thereof against the back of any other chimney, unless the back of each chimney in the cellar story be at least 8½ inches, and the back of each chimney in any of the upper stories, at least 4½ inches from the centre of such party-wall: and no chimney in any party-wall, where either of the buildings adjoining thereto is of the second, third, or fourth rate or class of building, shall be built with the back thereof against the back of any other chimney, unless the back of each chimney in the cellar story be at least 6½ inches, and the back of each chimney in any of the upper stories at least 4½ inches from the centre of such wall: and no flue shall be built opposite to another flue in any party-wall, unless the back of each flue be at least 2 inches from the centre of such party-wall; the breast of every flue, whether such flue be in a party-wall or not, shall be of brick or stone at least 8½ inches thick in every cellar story, and at least 4 inches thick in every other story. All the withs or partitions between flues shall be of brick or stone, and every such with or partition of brick shall be at least half a brick thick: and every breast and back of every chimney, and every breast, back, and with or partition of any flue shall be tendered or pargetted within and without, except the outside thereof which shall be next to vacant ground, in which case the back of every chimney and flue next such vacant ground shall be by lime or in some durable manner marked and distinguished, except in a four-front, back-front, or side-front of any building not likely hereafter to be built against; and every back of every such chimney and flue so being against such vacant ground shall be rendered or pargetted as soon as any building shall be erected to such wall.

Provided always, and be it enacted, that if any person or persons, being possessed of, or entitled unto, any part of the ground whereon a party-wall is intended to be built, shall be desirous of having chimney-jambs, breasts, and flues of chimneys, made in any such party-wall on his, her, or their part thereof, or shall be desirous of having a recess or recesses left in the said party-wall, for the purpose of inserting external or internal walls or piers, or for any other purpose allowed by this act, and shall give notice of such desire in writing under his, her, or their hands, particularly describing every such chimney-jamb, breast, and flue, and every such recess, to the builder or builders of such party-wall, or any one of them, at any time before such party-wall shall be begun to be built, then such builder or builders of such party-wall shall, after such notice so given, erect in a proper, substantial, and workmanlike manner, such and so many chimney-jambs, breasts, and flues of chimneys, in all such parts of every such party-wall as shall be by the person or persons giving such notice required; and shall also leave such recesses in every such party-wall, not being in any respect contrary to the rules, regulations, and restrictions in and by this act prescribed; and from and after the erecting such jambs, breasts, and flues of chimneys so required, the person or persons giving such notice, his, her, or their executors and administrators, shall be deemed to have made use of such party-wall, and shall from thenceforth be liable to pay the whole expense of erecting and setting up all such jambs, breasts, and flues of chimneys erected in pursuance of such notice, and also such proportional part of the expense of erecting such wall as is herein-after directed concerning party-walls.

And whereas several houses and other buildings are built within the aforesaid limits, over a public way, and several of the rooms or floors of such houses or buildings are the property of different owners, and lie intermixed without being separated by any party-wall, and without being arched over and under each other with brick or stone, or brick and stone throughout; be it therefore enacted, that when any house or other building, except as herein-after is excepted, so built, in any part thereof, over a public way or any house or building, except as herein-after is excepted, having any rooms the property of different persons, and intermixed as aforesaid, shall be rebuilt, there shall be a party-wall, according to the directions herein-before contained for the highest rate or class of building adjoining thereto, with a party-arch or party-arches of the thickness of one brick and a half in length, or 13 inches at the least, in every building of the first and second rate, and of the thickness of one brick in length, or 8½ inches at the least in every building of the third and fourth rate, between house and house, or other building, or between the different rooms or floors, being the property of different persons as aforesaid.

This last mentioned clause does not extend to any of the four inns of court, or to any of the inns of chancery, or any other inns set apart for the study or practice of the law; except that the walls or divisions between the several rooms and chambers, belonging to, and communicating with, each separate and distinct staircase of such inns shall be deemed and taken to be party-walls within this act, and subject to the regulations and clauses herein contained relating to other party-walls within the aforesaid limits.

And whereas it may sometimes happen, that no party-wall, or party-arch, can be built upon proper foundations between such houses and other buildings, over public ways, or having rooms and floors the property of different persons, lying intermixed, without pulling down such houses and buildings; it is enacted, that, when any owner of a house or building, that is intermixed, or built over a public way, shall be desirous of rebuilding the same, and the owner of the adjoining house or building shall not be willing, or shall not, by reason of some legal disability, or otherwise, be able to join in such rebuildings, then the party desirous of rebuilding, shall give notice in writing to the owner of the adjoining house, of his intention to apply to the court of mayor and aldermen of the city of London, or to the justices of peace for the counties of Middlesex or Surrey or of the liberties of Westminster, as the case may be, at the general or quarter sessions, to be next holden, after fourteen days from the delivery of such notice; in order to obtain judgment and determination touching the rebuilding of such house or houses, or other buildings, or of ascertaining the site of a party-wall or party-walls, or of the situation of any party-arches to be built according to the directions and restrictions contained in this act, by delivering a true copy of such notice to the owner of such adjoining house, or other part of such intermixed house or building; or in case the adjoining house be uninhabited by fixing such copy, wrote fair and in a legible hand, to or upon the door, or some other notorious part of such adjoining or intermixed house; and by this act, jury are to determine the expense to be paid by the owner or owners of the adjoining house or houses; and after the expiration of fourteen days from and after the obtaining such judgment, and payment or tender of the money awarded, the owner of the intermediate house may pull it down; and to that end shall and may, in the presence of a constable or head-borough, or other officer of the peace, enter upon the site of the ground, and into the house or other building adjoining to the party-wall, &c. intended to be rebuilt, at any time between the hours of six in the morning and seven in the afternoon, (Sundays excepted;) and if the outer door of such house, or other building be shut, and the occupier or any other person therein refuse to open the same; or if such house or other building be empty and unoccupied, he shall and may break open such outer door, and remove to some other part of the same premises, or in case there be not sufficient room on the premises for that purpose, to remove to any other place, any goods, furniture, shelves, or other thing obstructing the building of such intended party-wall or party-walls, party-arch or party-arches, or the pulling down any wall, partition, or other thing necessary to be pulled down and removed, in order to the building such intended party-wall or party-walls, party-arch or party-arches, and from and after such entry, and at all usual times of working, it shall be lawful for the builder or builders employed to erect such intended party-wall or party-walls, party-arch or party-arches, and his and their servants, and all others employed by him or them, to enter into and upon the premises, and abide therein the usual times of working, for the shoring up the said house or other building so broke into or entered upon, and for taking down and removing any party-wall or party-walls, partition, wainscot, or other thing necessary to be taken down and removed for the purpose aforesaid, and to build such intended party-wall or party-walls, party-arch or party arches: and if any such owner or occupier or other person or persons, shall in any manner hinder or obstruct any workman or workmen employed for any of the purposes aforesaid, or wilfully damage or injure the said works, every such owner or occupier, or other person so offending, shall, for every such offence, forfeit and pay the sum of ten pounds.

Provided also, and it is hereby further enacted, that within ten days after such party-wall or party-walls, party-arch or party-arches, shall be so built, the person who shall have rebuilt the same shall leave a true account in writing of the expense of rebuilding with the party or parties so awarded by the jury as aforesaid to contribute to the expense, or at his, or their last or usual place of abode; who shall pay to the person or persons who shall have rebuilt such party-wall or party-walls, party-arch or party-arches, the proportion of the expense of building the same as awarded by the jury, within twenty-one days after demand, or, in case the same be not so paid, it shall be lawful for the tenant or occupier of the house or building so chargeable therewith, to pay the same, and to deduct the money so paid out of the next rent which shall become due to the owner or owners of such house or building; or the same may be recovered from the party or parties so awarded to pay the same by action of debt, bill, plaint, or information, in any of his majesty's courts of record at Westminster, with double costs of suit.

And whereas it may happen, that party-walls, or party-arches, or party fence-walls, may be defective, or so far out of repair, as to render it necessary to pull down and rebuild the same, or some part or parts thereof; it is enacted, that every owner of any building within the limits of this act, who may think it necessary to repair or rebuild the party-wall between his and the adjoining premises, is to give three months notice in writing, to the owner of the adjoining building, appointing a survey to be made of the said wall, and naming two surveyors, or able workmen, on his part, and requiring the other party also to name two surveyors, to meet at an appointed place, to view and certify the state of the wall. This notice must be in the form or to the effect following.

Apprehending the party-wall, party-arch, or party fence-wall, or some part thereof (*as the case shall be,*) between the house or building, or ground (*as the case shall be,*) thereto adjoining, situate inhabited or occupied by and my house or building, or ground (*as the case shall be,*) adjoining thereto, to be so far out of repair as to render it necessary to repair or pull down and rebuild the same, or some part thereof: take notice, that I intend to have the said party-wall, party-arch, or party fence-wall (*as the case shall be*) surveyed, pursuant to an act of parliament made in the fourteenth year of the reign of king *George* the third; and that I have appointed of and of my surveyors, to meet at in (*being at some place within the limits aforesaid,*) on my behalf, on the day of next, at of the clock in the of the same day (*being between the hours of six in the morning and six in the afternoon:*) and I do hereby require and call upon you to appoint two other surveyors or able workmen on your part, to meet them at the time and place aforesaid, to view the said party-wall, party-arch, or party fence-wall, (*as the case shall be,*) and to certify the state and condition thereof, and whether the same, or any part thereof, ought to be repaired or pulled down and rebuilt. Dated this day of

A. B.

If the owner of the adjoining premises shall neglect to appoint two surveyors on his part, according to notice, then the two surveyors first named, together with two other surveyors, to be named by the party giving notice, may, within six days after the time appointed in the notice, view the party-wall, and certify in writing, under their hands, to the court of mayor and alderman, or to the justices of the peace, in their next quarter or general sessions, as the case may be, the condition of the party-wall, and whether the same, or any part thereof, ought to be repaired and rebuilt, and in case the major part of the surveyors shall not, within the space of a month from the time of appointment, sign the certificate, then it shall be lawful for any one or more of the justices of the peace for London or Westminster, or the county of Middlesex or Surrey, as the case may be to appoint one other surveyor to be added to the surveyors before appointed, all or the major part of whom are to meet, and view the party-wall; and in case the major part of them shall certify the wall to be decayed or ruinous, and not sufficiently secure from fire, then, within three days from the making of such certificate, a copy of it is to be delivered to the owner of the adjoining building, or affixed to the door if it be unoccupied, and also filed with the clerk of the peace of the city, county, or liberty, where such wall is situate; and the last mentioned owners may appeal from the certificate to the next general or quarter sessions, when the justices are to summon before them one or more of the surveyors, and examine the matter upon oath, and thereupon make such orders as they think just.

And whereas several old houses and other buildings of the first, second, or third rate or class of building within the limits of the act, have instead of party-walls of the respective thicknesses herein-before directed, party-walls of not greater thickness than one brick and a half in length, or 13 inches from the foundation to the ground floor, or than one brick in length, or 8½ inches from thence to the coping: and as disputes may arise concerning the pulling down such old party walls, and rebuilding the same agreeably to the rules and directions herein contained, it is enacted, that whenever the owner or owners of any or either of the houses or buildings adjoining to any such party-walls shall be desirous of pulling down and rebuilding such house, or so much of the same as may subject the party-walls to the rules and regulations contained in this act, and of such desire shall give three months' notice in writing to the owner or occupier of the next adjoining house or building, then and in that case, from and after the expiration of the three months expressed in such notice, it shall be lawful for the owner of such house or building so intended to be rebuilt, to pull down the said party-wall, and to have and exercise the like power of entering into and upon the said adjoining house or building, or of breaking open the same, in the presence of a peace officer, in case the same be unoccupied, or be refused to be opened, and of removing any wainscot, shelves, furniture, or other things, and of shoring up the said adjoining house or building, as by this act is given and allowed to the owners of intermixed houses or buildings, and shall and may, in the place and stead of every such old party-wall, build a new party-wall of such materials, thickness, and height, and in such manner, and subject to such restrictions and directions, as are in and by this act prescribed.

And whereas several old houses or other buildings within the limits of the act, have instead of a party-wall, one timber or wood partition, or two old timber or wood partitions, with or without brick nogging, it is enacted that, whenever it may be expedient to rebuild any such house or building, or so much thereof as may subject the same, and the partitions abutting on the same, to the rules and regulations contained in this act; the owner shall in like manner, give three months' notice, and proceed as directed above.

And it is further enacted, that the person, at whose expense a party-wall or party-arch is built, shall be reimbursed by the owner of the adjoining premises, who makes use of the wall a part of the expense in the following proportion. If the adjoining building be of the same, or of a superior class, to the building belonging to the person at whose expense the party-wall was constructed, the owner of such adjoining building shall pay one moiety of the expense of so much of the party-wall as he shall make use of: but if the adjoining building be of an inferior rate, the owner shall pay a sum equal to a moiety of the expense in building a party-wall, as required by this act for such class of building: and in the mean time, and until such moiety or other proportionate part of the expense of building such party-wall or party-arch be paid, the sole property of the party-wall or party-arch, and the ground on which it stands, is to be vested entirely in the person or persons at whose expense the same has been built. And with respect to the mode of payment, it is directed, that the party, at whose expense the party-wall has been built, shall be paid by the owner of the adjoining premises, who makes use of the said party-wall, as follows; first, if such party-wall were built before any other house adjoined it, the owner of the adjoining ground shall pay his portion of the expense before he begins to cut into or make use of such party-wall; and secondly, if such party-wall or party-arch be built against or adjoining to any other house or building, then the owner of such adjoining house or building shall pay his proportion of the expense of building such party-wall, as also a proportional part of all other expenses which shall have been necessary to the pulling down the old party-wall, or timber or wood partition, the shoring up of the adjoining building, the pulling down of wainscot or partition, &c., but not the expense of pulling down and clearing away such party-wall, &c., immediately that the said party-arch or party-wall be completely built and finished.

It is also directed by the act, that the expense of building such party-wall or party-arch shall be estimated after the rate of seven pounds fifteen shillings by the rod for the new brickwork, deducting therefrom after the rate of twenty-eight shillings by the rod of 272 feet for the materials (if any) of so much of the old wall or arch as did belong to such adjoining building or ground, and also after the rate of twopence by the cubical foot for the materials of so much of the old timber partition as may have belonged to the adjoining ground or building; but as materials and labour have greatly advanced since the act was passed, it is usual to allow an extra price according to the work, by surveyors; and an extra for the old brickwork, as also for the old sound timber.

It is also further enacted, that, within ten days after such party-wall or party-arch has been built, the builder shall leave at the adjoining house a true account in writing of the number of rods in such party-wall or party-arch, and of the deductions to which such owner is entitled; whereupon it is lawful for the tenant or occupier of the adjoining building or ground to pay one moiety, or other proportional part, to the builder of the party-wall, as also all such other expenses as are herein-before directed, and to deduct the same out of the rent. In case the same be not paid within twenty-one days, it may be recovered with full costs of suit by action of debt; and if the plaintiff give three months' notice to the defendant before he brings the action, and recover the whole amount of charge, he is entitled to double costs.

Every party-wall or addition made thereto, shall be built agreeably to the directions contained in the act concerning the party-wall of the highest rate or class of building to which such party-wall adjoins; and no party-wall shall, after the same and the buildings adjoining thereto is and are completed, be raised, unless the same when raised be of the full thickness such party-wall is of in the story next under the roof of the highest adjoining building; nor shall any party-wall be raised, unless the same can be done with safety to such wall, and the several buildings adjoining thereto; but all such party-walls as will, when raised, be of the materials, heights, and thicknesses required by the act, or as can be safely raised, may, together with the shaft or shafts of the chimneys, be raised, by and at the expense of the proprietor or occupier of any building to which the same belong, to any required height; but if the proprietor or occupier of any building adjoining to the said party-wall and chimney shafts, shall make use of any part of such party-wall and chimney shaft, other than the use he makes of the chimney flues, then such person shall be chargeable with a proportionable share of the expense of raising such party-wall and chimney-shafts; and in computing such charge the same shall be rated in manner herein-before mentioned, and the proportion such person shall be liable to pay shall be recovered in such manner as is herein-before particularly declared concerning the first building of a party-wall.

Any party fence-wall may be raised by, and at the expense of, the proprietor or occupier of the ground on either side of it; but no party fence-wall is to be built upon, or against, or used as a party-wall, unless the same be of materials, height, and thickness herein-before directed for party-walls to the rate or class of building so to be erected against or upon the same: and in case of the insufficiency of such wall for the aforesaid purpose, or if instead of such party fence-wall there be only a wooden fence, the proprietor or occupier of either of the adjoining premises shall be at liberty, at his own expense, to take down such wall or fence, and erect a new party-wall in lieu of it, provided he makes good every damage that may accrue to the adjoining premises by such rebuilding, and that the new party-wall does not extend on the surface of such adjoining ground more than 7 inches beyond the centre line of such party fence-wall, but no proprietor or occupier of such adjoining premises is to make use of such party-wall, otherwise than as a party fence-wall, unless he pay a proportionable share of the whole expense of erecting such parts of such wall according to the use he shall make of the same.

If any party-wall extend further upon the ground of the party building the same than the party fence-wall did, the party rebuilding the same are not to lose any part of the soil whereon such party-wall be built, nor shall the owner or owners of the other part of such party-wall claim or be entitled to any right or soil more than what he was before entitled to.

If the fore or back front of any building now built shall hereafter be rebuilt as low as the bressummer, or one pair of stairs floor, within the space of five years from each other, then the party-walls shall, in all respects be subject to the several regulations of the act.

Regulations respecting chimneys that are not in party-walls. The back of every chimney from the hearth to the height of 12 inches above the mantle, in every first rate or class of building, not being in a party-wall, shall in the cellar story be at the least 13 inches thick, and in every other story 8½ inches; and in every second, third, or fourth rate or class of building, 8½ inches thick in every story; excepting where any such chimney shall, in either case be built against a wall; in which case the back of every such chimney from the hearth to the height of 12 inches above the mantle may be half a brick thinner. It is also directed that no timber whatever shall be placed over the opening of any chimney to support the breast; but that the breast shall be supported by an iron bar, or by an arch of brick or stone: and that no timber shall be laid in any wall under the hearth of any chimney, unless the same be at the least, 18 inches below the surface of such hearth. The hearth of every chimney shall be laid wholly on brick or stone, except the same be in a cellar or ground story, and be laid and bedded on the solid earth; and every such chimney shall have a slab or slabs, or foot paces before the same, of tile, stone, marble, or iron, at least 18 inches broad, and 1 foot longer than the opening of every such chimney when finished; and such slab or slabs, or foot paces, shall be laid on brick or stone trimmers, at least 18 inches broad from the opening of such chimney, or from the perpendicular face of the arch over the opening which supports the breast, except the same be in a cellar or ground floor, and be laid and bedded on the solid earth. No timber or wood-work whatever shall be laid in the brickwork of any oven, stove, copper, still, boiler, or furnace, nor within 2 feet of the inside of any such oven, stove, copper, still, boiler, or furnace; nor shall any timber whatever be laid in the brickwork of any chimney, nearer than 9 inches to the opening of such chimney, or than 5 inches to the inside of the flue of any chimney, oven, stove, copper, still, boiler, or furnace, or than 9 inches to the inside of the flue where any such timber shall lie; or be placed nearer than 5 feet above the mouth of the same. No wood work whatever shall be affixed to the front of any jamb or mantle, or to the front or back of any chimney or flue, except such wood work be affixed by iron nails or holdfasts, or other iron fastenings; which fastenings shall not be driven more than 3 inches into the wall, or nearer than 4 inches to the inside of the opening of any chimney: And no chimney shall be erected on any timber-work whatever, except on such piling, bridging, or planking, as may be necessary below the foundation of the building; but shall be erected on such piling, bridging, or planking, or on solid ground, or on a brick or stone foundation, or shall be set upon brick or stone corbels, or iron brackets, or upon iron shores, which iron shores shall be supported by brick or stone foundations.

Materials of external walls

Every external wall or external enclosure of every building of the first, second, third, fourth, or fifth rate or class of building, and of every addition or enlargement shall be of brick, stone, artificial stone, lead, copper, tin, slate, tile, or iron, or of brick, stone, artificial stone, lead, copper, tin, slate, tile, and iron together, except the necessary piling, bridging, and planking for the foundation, and also except the necessary templets, chains, bond timbers, doors, sashes, window shutters, and door and window frames to such buildings, and the tiers or stories of door cases and doors to all such warehouses as are or shall be of the first, second, third, or fourth rate or class of building; all which window and door frames with the exception of those belonging to warehouses shall be let in reveals, and recessed at least 4 inches from the front of the building. Also except all stall boards, bressummers, story posts, and plates on the ground story, which bressummers and story plates shall not be fixed more than 2 inches deep, in any party-wall, nor placed in any front nearer than 7 inches to the centre line of the party-wall, when such party-wall is of the thickness of two bricks, or nearer than 4½ inches to the centre of such party-wall, when it does not exceed one brick and a half in thickness; but no timber work whatever, other than and except such bressummer, story posts, and plates, and such tiers or stories of door cases and doors, shall be laid in any such external wall nearer than 4 inches to the external surface; and every such story post which shall be fixed as asupport to two fronts, being the corner of any street, square, place, court, or way, shall be of oak or stone, and at least 12 inches square.

It is also further directed, that every flat, gutter, and roof of every building of the first, second, third, fourth, or fifth rate or class of building, and every turret, dormer, and lantern light, or other erection, which shall be placed in the flat or roof, and which shall, at any time, be ripped or uncovered, shall be covered with glass, copper, lead, tin, slate, tile, or artificial stone; with the exception of the doors, door frames, windows, and window frames.

Materials of external decorations. Every coping, cornice, facia, window dressing, portico, balcony, balustrade, or other external decoration or projection to any building of the first, second, third, or fourth rate; and also every frontispiece to any building of the first rate or class of building, or to any addition or enlargement of such building, shall externally be of brick, stone, burnt clay, or artificial stone, stucco, lead, or iron; except the cornices and dressings to shop windows; and also except such covered ways as may hereafter be made to any building, so, nevertheless, as that the said covered way, or any part thereof, shall not extend beyond the original line of the houses in the street or way in which the same shall be or is erected, and such covered way shall be covered with stone, lead, copper, slate, tile, or tin; and neither the said covered way, nor the cornice, or dressings to any shop window, nor the roof of any such portico, shall be higher than the under side of the cill of the window frame of the one pair of stairs window. It is also directed that no water shall be suffered to drip next to any public way, from the roof of any building of the first, second, third, or fourth rate or class of building, except from the roofs of porticoes or other entrances; but that all water from such roofs shall be conveyed by lead, copper, tin, or iron gutters or pipes, or by wooden trunks, or by brick or stone funnels, to the drains or channel stones, on or below the surface of the ground, or to some cistern or other reservoir made to receive the same. And no bow-window or other projection shall be built with, or added to any first, second, third, or fourth rate building next to any public street or way, so as to extend beyond the general line of the fronts of the houses in the said street, except such projections as may be necessary for copings, cornices, facias, door and window dressings, or for porticoes, steps, or iron palisades; and also except such window to any shop or shops on the ground floor story; the stall boards of which windows shall not, in any street or way that is less than 30 feet wide or more, project above 10 inches, nor in any street or way that is less than 30 feet wide, above 5 inches from the upright line of building in such street or way respectively: and no cornice or covering to any such shop window, shall, in any street or way that is 30 feet wide or more, project more than 18 inches, nor in any street or way that is less than 30 feet wide, more than 13 inches from the upright line of the building to which such shop window belongs: and no bow-window or other projection, except as before excepted, shall be built with or added to the front of any building of the first, second, third, or fourth rate or class of building, unless the same, and the columns and pilasters (if any) which support the same, be built of the several materials herein-before directed to be used in all external walls or external enclosures.

Repair of old external walls. Every external wall, or other external enclosure, to any building, which was built before the passing of this act, and which is not of the several materials therein required may at all times be repaired with the same sort or sorts of materials as the materials of which such external wall or other external enclosure is erected, (except the external enclosures of roofs, flats, gutters, and of the dormers, turrets, and lantern lights, or other erections on the same, which shall be repaired with the materials herein-before directed for the same;) but in case any such external wall, or other external enclosure, be at any time hereafter taken down or otherwise demolished to the bressummer or one pair of stairs floor, or the place where the bressummer is usually fixed, then every part of the same, not being built of the several materials in and by this act required for external walls or other external enclosures, shall be taken down, and the same shall be entirely rebuilt of such materials, and in such manner, in all respects, as is by this act required for all external walls, or other external enclosures, according to the rate or class of building to which such wall or other external enclosure belongs.

And no bow-window or other projection shall be rebuilt, except such projections as are in and by this act allowed, unless such bow-window or other projection was built at the same time the house or building to which the same belongs was built, or unless such bow-window, or other projection be within the original line of the street, square, place, court, or way, in which the same is erected.

Sundry particulars relative to buildings. No stack of warehouses shall contain more than thirty-five squares, and no stables more than twenty-five squares, of building on the ground plan, including all the external and internal walls, and so much of the party-walls (if any) as belong to such stack of warehouses or building for stables; and no enlargement shall be made, so as to increase the same beyond the said number of squares on the ground plan, except such stack of warehouses or stables be separated and divided by one or more party-wall or party-walls, built in every respect according to the directions herein-before contained concerning party-walls, into divisions of not more than the said number of squares each, including such walls as aforesaid on the ground plan; and no stack of warehouses or building for stables shall communicate with any other warehouse, stable, or building through a party-wall, unless the door case and cill of every such communication be of stone, and unless there be to every such communication a door of wrought iron, of the thickness of a quarter of an inch at least in the panels; and no timber, bond, or lintel, shall be laid into the brickwork of any wall in any such stack of warehouses or building for stables, nearer than 18 inches to the opening of such communication.

If any building of the first, second, third, or fourth rate or class of building, (except the several inns of court or chancery, the *royal exchange,* companies halls, and warehouses and dwelling-houses let at a rack rent for not more than twenty-five-pounds per annum,) be at any time hereafter converted into two or more dwelling-houses, workshops, stables, or other buildings, which shall be in distinct tenures on the ground floor, then each tenement shall be considered as a separate building, and the same shall be divided from each other by a party-wall or party-walls; and every such party-wall shall be of the materials, height, and thickness, and shall be from time to time under the several regulations respecting party-walls herein directed to be observed with respect to the party-wall of the highest rate or class of building adjoining to such party-wall.

Provided, nevertheless, that nothing which this act contains shall prevent any person, being the proprietor or leaseholder of any stack of warehouses or building for stables from dividing the said warehouses or stables from time to time into divisions, for the conveniency of letting the same to under tenants.

If any building of the fifth or sixth rate or class of building be divided into two or more distinct tenures, and the several parts of such building in such separate tenures be not at the several distances from each other herein-before particularly directed for every such fifth or sixth rate building; then every such several part of such building in every such separate and distinct tenure, being nearer to each other than the said several distances, shall be deemed a public nuisance, and shall be immediately taken down.

And no pipe or funnel, for conveying smoke or steam, shall be fixed next any public street, square, court, or way, on the front of any building of the first, second, third, or fourth rate or class of building; nor shall any such pipe or funnel be fixed on the inside of any such building nearer than 14 inches to any timber or other combustible material whatever; nor shall any brick funnel be placed on the outside of any front, next to the public way, of any building of the first, second, third, or fourth rate or class of building, so as to extend beyond the general line of the houses in the public way in which the same is erected.

Every church, chapel, meeting-house, dwelling-house, or other building, and every party-wall and other wall within the limits of this act, shall be built pursuant to such rules and regulations, and with such materials, as are herein-before particularly appointed; and if any person presume to build contrary to these regulations, and be convicted within three months after the building is finished, by the oaths of two or more credible witnesses before the magistrate in whose jurisdiction such may be, then the said house, building, or wall, so irregularly built or begun to be built, or altered, shall be deemed a common nuisance; and the builder shall enter into a recognizance, in such sum as the magistrate shall appoint, for abating and demolishing the same within a convenient time, or otherwise to amend the same according to such rules and regulations as are herein-before contained; and in default of entering into such recognizance, he shall be committed to the common goal, there to remain without bail or mainprize until he shall have abated, demolished, or otherwise amended the same.

The magistrates are empowered to order every house or building so irregularly built or begun t be built, or altered as is by th act declared to be a comm nuisance, to be abated or tak down, by the person or perso authorized to abate or take dow the same, and to order the sa and disposal of the materials t pay the charges of so abating o taking it down, and if there b any surplus of moneys arisin from such sale, it is to be paid t the owner or owners of the mat rials; but if the moneys arisin from such sale be not sufficient t pay the charges, the deficienc shall be made good by the owne or owners, and may be levied as herein-after directed concernin the expense of taking dow ruinous buildings and puttin up hoards for the safety of passengers.

The mayor and aldermen o London, the justices of the peac for the county of Middlesex, o Surrey, the city and liberty o Westminster, and the liberty o his majesty's tower of London may nominate and appoint persons, skilled in the art of building, to be surveyors or supervisors to see the said rules an regulations well and truly observed. And the said justices i their respective quarter session shall administer to the said surveyors and supervisors by ther respectively appointed, an oat for the true and impartial execution of their office, and whic oath shall be in the form, or t the effect following; that is t say:—

"I, *A. B.* being one of the surveyors or supervisors appointe in pursuance of an act of parliamant, passed in the fourteent year of the reign of king *Georg* the third, *for the further and better regulation of buildings and party walls; and for the more effectuall* *preventing mischiefs by fire within the cities of* London *and* Westminster, *and the liberties thereof, and other the parishes, precincts, and places, within the weekly bills of mortality, the parishes of* St. Mary-la-bonne, Paddington, St. Pancras, *and* St. Luke *at* Chelsea, *in the county of* Middlesex; *and for indemnifying, under certain conditions, builders, and other persons, against the penalties to which they are or may be liable for erecting buildings within the limits aforesaid, contrary to law,* do swear, that upon receiving notice of any building or wall to be built, or other builders' work to be done, within the district under my inspection, not being by illness or otherwise lawfully prevented, I will diligently and faithfully survey the same, and to the utmost of my abilities endeavour to cause the rules and regulations, in the said act prescribed, to be strictly observed; and that without favour or affection, prejudice or malice.

"So help me God."

And such surveyor or supervisor shall, from time to time, leave notice in writing with the clerk of the peace for the county, city, or liberty, in which his district shall be situated, of the place of his usual residence or abode.

It is also hereby further enacted, that before any building or any wall, or new or old foundations, or foundations partly new and partly old, within the limits of this act, shall be begun to be built, the master workman, or other person causing such building or wall to be built, shall give twenty-four hours' notice thereof to the surveyor or supervisor, within whose district the same shall be; and such surveyor or supervisor shall view the said building or wall, and see that all the rules and regulations in this act contained are well and truly observed; and such surveyor or supervisor, for his trouble therein, shall be paid by such master workman, or other person causing such building or wall to be built, such sum of money as a satisfaction for his trouble therein, as any two or more of his majesty's justices of the peace for the city, county, or liberty in which such building or wall is situate, shall, by any writing under their hands, order or appoint, not exceeding three pounds ten shillings for every new building of the first rate or class of building, or one pound fifteen shillings for every first rate building to which any alteration or addition shall be made, and not exceeding three pounds three shillings for every new building of the second rate or class of building, or one pound ten shillings for every second rate building to which any alteration or addition shall be made; and not exceeding two pounds ten shillings for every new building of the third rate or class of building, or one pound five shillings for every third rate building to which any alteration or addition shall be made; and not exceeding two pounds two shillings for every new building of the fourth rate or class of building; or one pound one shilling for every fourth rate building to which any alteration or addition shall be made; and not exceeding one pound ten shillings for every new building of the fifth rate or class of building, or fifteen shillings for every fifth rate building to which any alteration or addition shall be made; and not exceeding one pound one shilling for every new building of the sixth rate or class of building, or ten shillings and sixpence for every sixth rate building to which any alteration or addition shall be made; and not exceeding ten shillings and sixpence for every new building of the seventh rate or class of building, or five shillings for every seventh rate building to which any alteration or addition shall be made; and, in default of payment of any of the said several sums of money, or such other sums as the said justices shall appoint, the same shall, by warrant of one or more of such justice or justices as aforesaid, be levied by distress and sale of the goods and chattels of such master workman, or other person as aforesaid, together with the reasonable costs and charges of such distress and sale.

And if any person shall begin any building, or wall, or shall presume to cut into any party-wall, without first giving notice to the surveyor, or supervisor, within whose district the same is situate, or shall refuse such surveyor or supervisor admittance from time to time, at reasonable hours, for the purpose of viewing the same; then every person so neglecting to give such notice, or so refusing such admittance, shall, for every default therein, forfeit and pay to the said surveyor or supervisor treble the satisfaction which such surveyor or supervisor would have been entitled to receive for his trouble in viewing such building or wall, in case such notice had been given; and shall also, for every such default, forfeit the sum of twenty pounds, to any person or persons who shall sue for the same.

And if any workmen shall wilfully, carelessly, or negligently, and without the direction, privity, or consent of his master do any thing in or about such building or wall contrary to the directions of this act, every such workman or servant so offending, shall, upon conviction, forfeit the sum of fifty shillings; one moiety thereof be paid to the overseers of poor of the parish, precinct, place, wherein the offence v committed, for the use of the p only, and the other moiety ther to the informer; and if such f feiture be not paid upon, and i mediately after, such convicti then the offenders shall be co mitted to the house of correcti there to remain, without bail mainprize, for any time not ceeding three months, nor l than one month, unless the pena be sooner paid.

Every master workman w shall build any house or otl building, or any addition there or any party or other wall, or w shall be employed to cut into a party-wall within the limits of t act, shall cause the same to surveyed within fourteen da after the same is completed the surveyor or supervisor with whose district the same is situat and, in case the said survey shall refuse, neglect, or shall, illness or otherwise, be prevent surveying such building, wall, other work, then the same sh be surveyed by any other survey or supervisor appointed and swo within the city, county, or liber wherein the work is situate; a if such surveyor or supervis shall, upon such survey, find th the same is, to the best of h judgment and belief, built or ma good, agreeably to the seve directions contained in the a then such surveyor or supervis shall, within fourteen days aft surveying the same, make oa thereof, by affidavit in writin before the magistrate within who jurisdiction the same is situat which affidavit shall be filed wi the clerk of the peace for t county, city, or liberty in whi the said building or wall is situa

thin ten days, and the said
rk of the peace shall, for his
uble therein, be entitled to
d receive the sum of one shil-
g, and no more: and if any
rson make default in the pre-
ses, by neglecting to cause
ch survey to be made, or such
idavit to be made and filed, he
all for such neglect forfeit the
m of ten pounds; and if such
idavit be not made and filed
thin the space of one month
xt after the recovery of such
nalty, such master workman,
other person as aforesaid, shall
rfeit the further sum of ten
unds per month, until such
ilding be certified.

It is further enacted, that if any
rveyor, or supervisor, appointed
d sworn in manner herein-be-
re directed, shall at any time
ilfully neglect his duty, or be-
ave himself negligently or un-
ithfully in the discharge thereof,
e shall be forthwith discharged,
d shall for ever afterwards be
capable of being again appoint-
d a surveyor, or supervisor, for
e aforesaid purposes.

And whereas houses and build-
gs within the limits of the act,
e often, either from litigated
tles, or the obstinacy, neglect,
r poverty of the owners in so
uinous a condition, that the
ves of passengers are thereby
ndangered; it is further enacted,
at if any presentment be made
y an inquest or grand jury in
ondon, or by an annoyance
ry within the city and liberty
f Westminster, or by the jury
worn at the court leet held by
he sheriff in his turn for any hun-
red or place, or by any other
ry or inquest sworn within any
ther part of the limits aforesaid,
hat any house or building within
he same limits, or any part there-
f, is in a ruinous condition, it
shall be lawful for the court of mayor and aldermen, in respect of any such house or building within the said city of London, and the liberties thereof, or for the churchwardens or overseers of the poor for the time being of such parish, precinct, or place not being in the city of London, or the liberties thereof, in which such house or building is situate, to cause, with all convenient speed, a proper and sufficient board to be put up for the safety of passengers, and to cause notice in writing to be given to the owner, or other person interested therein, and if such owner cannot be found, to cause notice in writing to be affixed to or upon the door or other notorious part of such house or building, to repair the same, or to pull down such building, as the case may require, within fourteen days then next ensuing: and if such owner or other interested person do not begin to repair or take down the same within the said fourteen days, the said court of mayor and aldermen, by and out of the cash in the chamber of London, and also every such churchwarden and overseer of the poor, by and out of the moneys in his hands, are hereby severally authorized and required, with all convenient speed, to order and cause such house or building or so much thereof as the said court, or the said churchwardens or overseers of the poor, find necessary for the safety of passengers, to be taken down and secured, in such manner as shall from time to time be requisite; and to sell and dispose of such of the materials as they shall judge necessary and expedient to reimburse, repay, and satisfy to themselves, and every person by them respectively employed, the charges of putting up

such board, and of taking down and securing all or any part of every such house or building. The surplus of the moneys arising from such sale (if any there be) is to be paid to the owner of every such house or building, upon personal demand, and if no such demand be made before another or other overseer or overseers of the poor of the said parish, precinct, or place be appointed, then such overplus shall be added to the moneys raised and collected by virtue of the rates made for the relief of the poor of the said parish, precinct, or place, and shall be accounted for as such. Provided, nevertheless, that if any owner, or his executors or administrators, shall and may, at any time within the term of six years be entitled to receive such overplus; then every such churchwarden or overseer for the time being is required to pay the same within ten days after personal demand out of any moneys raised by any rate or rates for the relief of the poor; but, if it happen that the moneys arising from such sale shall fall short and are deficient to repay and satisfy all such charges, then such deficiency shall be paid by the owner or owners of every such house or building, if known, and to be met with; and if such owner or owners, on demand, neglect or refuse to pay the same, then such deficiency may be levied by distress and sale of the goods and chattels of such owner or owners, if any such can be found: and if no such owner or owners can be met with, or, being met with, shall not on demand pay the said deficiency, and no sufficient distress of his goods and chattels can be met with, wherefrom such deficiency of costs and charges may be levied and recovered, then the person or person who shall at any time afterwards occupy any such house or building, or the ground whereon the same stood, is required and authorized to pay and deduct the same out of the rent thereof; and if the occupier neglect or refuse to pay such deficiency of charges, then the same shall be levied by distress and sale of the goods and chattels of such occupier of the premises, together with the costs of such distress and sale.

Having, in this place, furnished the reader with a faithful abstract of such parts of the building act as relate particularly to the erection of edifices, we shall for further information relative to the business of the bricklayer, refer him to the next article.

Bricklaying. The art of erecting edifices or walls with bricks cemented together with mortar.

For the materials, tools, &c. used in bricklaying, see the articles brick, tile, mortar, tools, &c. also the mensuration of brickwork.

When an edifice is to be erected, the first thing to be attended to is the setting out of the ground, and the digging of the trenches for the foundation. If the intended building is to have no basement story, the trenches need not be of greater width than the intended width of the footings; but if there is to be a basement story, it will be necessary to make the excavations about 2½ feet or 3 feet wider than the intended thickness of the walls, to allow of room, not only for the footings, but for the workmen to perform their respective duties. The footings vary in thickness, according to the magnitude of the building, and usually project from 9 to 14 inches beyond the surfaces of the walls.

When the excavations have been made, the ground must be tried by repeated blows of a rammer, or by driving into it an iron spit, and working it backwards and forwards, in order to ascertain whether it be sufficiently firm to sustain the proposed weight of the building. If it be not sufficiently firm, it must be piled and planked, or sleepered and planked, as the case may require. The operation of piling and planking consists in driving large piles of wood, tapered at one end, and shod with iron, into the earth, till they extend the whole width of the footings; and then, at any distance, not exceeding 5 feet, driving another course; and so in continuation throughout the length of the walling. This operation being completed, the ground between the different courses of piles, in the longitudinal direction of the wall, is well rammed and made good. Planks of wood called sleepers, are then laid on the heads of the piles, in a transverse direction to the length of the building; and other planks are laid in the opposite direction, that is, with their length extending in the direction of the length of the wall, resting partly on the sleepers, and partly on the ground which has been made good. Sleepered and planked consists in placing planks of wood in a similar direction to the above, without having recourse to piling. When the intended walling is to be three bricks thick, the sleepers and planks should extend about [illegible] feet on each side of the wall, that is, the sleepers should be 6 feet in length.

When the soil in general proves firm, but hath in one or more places loose earth, the parts that are loose must be excavated, *until* the bricklayer arrives at a part that is sufficiently firm to sustain a pier or piers. These piers, similarly to the walls of a building, must have footings; and must be carried up till they are on an exact level with the first course of the footings of the wall, of which thickness the piers must terminate at the top. Sometimes, when not very loose, the ground may be made firm, by ramming into it large stones, after the manner of the paviors, which stones are close packed together, and are of a breadth at the bottom proportioned to the intended insisting weight.

In buildings where wells or cesspools are to be sunk, it would be advisable to have them made previously to the sinking of the foundations, as they answer two purposes: first, that of ascertaining the nature of the ground on which the building is to be erected; and secondly, that of supplying water for the bricklayers to slacken their lime.

In building upon an inclined plane, where the length of the wall is to be very great, and the inclination of the plane is very rapid, the bottoms of the trenches for the foundations should form a series of level steps; the extent of each of the levels being decided by the number of courses of brickwork that is necessary to bring the first level to a height with that of the second, and that of the second to a height with that of the third, and so on progressively. The number of courses of brickwork necessary to this purpose should never exceed four; consequently, when, for example, a wall is to be 100 feet in length, and the inclination of the ground on which it is to be built is 10 feet, the distance from one step to another, or the length of each level, will be 10 feet, because 10 feet, the tenth part of 100 feet, or the length of the wall, as also the tenth part of the amount of inclination, will give 10 feet, (the amount of inclination,) divided by 10 feet, (the number of levels,) 1 foot, which is equal to four courses of brickwork. In building upon an inclined plane, when there is to be a long range of buildings separated by party-walls into distinct tenures, or houses, as is frequently the case in forming the streets of large towns and cities, it would be as well, and perhaps better, to make the steps extend from party-wall to party-wall, which will make the distance from step to step 15 feet, and upwards, according to the extent of the frontage of each house.

In places where the soil is loose to any great depth, over which it is intended to place the apertures of the intended building, as the doors, windows, &c., while the parts on which the piers are to be erected are firm, the best plan is to turn an inverted arch under each of the intended apertures, as then the piers in sinking will carry with them the inverted arch, and by compressing the ground compel it to act against the under sides of the arch, which, if closely jointed, so far from yielding will, with the abutting piers, operate as one solid body. But on the contrary, if this expedient of the inverted arch be not adopted, the part of the wall which is under the aperture, being of less height, and consequently of less weight, than the piers, will give way to the resistance of the soil acting on its base, and not only injure the brickwork between the apertures, but fracture the window heads and cills.

In constructing so essential a part as the arch, great attention must be paid to its curvature, and we strongly recommend the parabolic curve as the best adapted for this purpose; but if, in consequence of its depth, this cannot be conveniently introduced, the arch should never be made less than a semicircle. The bed of the piers should be as uniform as possible; for, though the bottom of the trench be very firm, it will, in some degree, yield to the great weight that is upon it; and if the soil be softer in one part than in another, that part which is the softest will of course yield more to the pressure, and cause a fracture.

If the solid parts of the trench happen to be under the intended apertures, and the softer parts where the piers are wanted, the reverse of the above practice must be resorted to; that is, the piers must be built on the firm parts, and have an arch that is not inverted between them. In performing this, attention must be paid to ascertain whether the insisting pier will cover the arch: for if the middle of the pier rest over the middle of the summit of the arch, the narrower the pier is, the greater should be the curvature of the arch at its apex. When suspended arches are used, the intrados should be kept clear of the ground, that the arch may have its due effect.

The trenches for the foundations being completed, the bricklayer commences to lay the bricks. In walling in dry weather, when the work is required to be firm, the best mortar must be used; and the bricks must be wetted or dipped in water, as they are laid, to cause them to adhere to the mortar, which they would not do if laid dry; for the dry sandy nature of the brick would absorb the moisture from the mortar, and prevent adhesion.

If very heavy walling is to be erected on ground whose stability is in the least doubtful, it is advisable to lay chain-timbers on the top of the footings. The utility of this measure has been proved by the erection of the military hospital at Gosport, where this practice was carried into effect, and which hospital has not sustained a fracture; whereas many other military hospitals, erected on precisely the same principles, but without chain-timbers being placed on the footings, have not been so fortunate. The thickness of the first course of footings to these walls is seven bricks; and the first course of bricks above the chain-timbers four bricks and a half. These chain-timbers consist of pieces of stuff called *flitches*, being timber of 14 inches square divided down the middle.

In carrying up a building, the walling should be carried up as regular as convenience will permit, and ought never to be carried more than 4 feet out of level at a time, without having its contingent parts added to it. This is a very necessary precaution, for as all walls shrink immediately after building, the part which is first brought up will settle before the adjacent part is brought up to it. This is not sufficiently attended to by the London builders, whose buildings, by consequence, frequently sustain fractures.

When the walling has been carried up to about half the height of the windows, chain-timbers should be introduced throughout, to keep the piers steady. In heavy walling, these chain-timbers may be 6 inches by 9 inches, but in common buildings bond-timbers will answer the required purpose.

When there is a continuation of walling, or great weight of brickwork over a window or other aperture, it is a good practice to turn an arch above the lintel in the interior face of the wall, correspondent to that in the exterior face. Arches may also be advantageously turned above the lintels of doors in partition walls, as also above the lintels of the chimney breasts. Each of these arches should consist of three distinct courses of bricks, by means of which two advantages will be gained; first, less mortar will be used; and secondly, should at any time the door or the chimney breast be required to be raised, it can very easily be effected by taking away the first and second courses.

In bricklaying there are two descriptions of bond; the English bond, and the Flemish bond. In the *English bond* a row of bricks is laid lengthwise in the direction of the length of the wall, and is crossed by another row which has its length in the breadth of the wall, and so on alternately. Those courses which bind the parts of the wall together in the longitudinal direction are termed *stretching courses*, and the bricks *stretchers*; and those which bind them in the transverse direction *heading courses*, and the bricks *headers*.

The *Flemish bond* consists in the disposition of the bricks on the outside, or face-work, so that in the same course there shall be alternately a stretcher and a header. This latter description of bond is deemed the neatest and most elegant; but in the execution is attended with great inconvenience, and, in most cases, does not unite the parts of a wall with the same degree of firmness as the English bond.

It is very easy to conceive that a wall constructed after the manner of the English bond must have considerable strength; for the parts of a wall are less liable to separate the longer the bonds are: the bonds are greatest in the longitudinal direction of the bricks, for then one brick may be 4 inches in length against each of two others in the same course; which is the length that must be moved before they can separate without breaking.

In the introduction of the Flemish bond, strength has been sacrificed to a minute difference in the outside appearance. The defects of the Flemish bond are, in one or both faces, bilging away from the interior substance; or the failure of the wall, by its separating into two thicknesses along the middle, which sometimes takes place when there is a great superincumbent weight on it, and is called splitting. To prevent this evil, some bricklayers place laths, or the iron of hoops occasionally, in the horizontal joints between two courses: others lay diagonal courses of bricks at certain heights from each other; but the good effects of this last mode is much doubted, as in the diagonal course, by not being continued on the outside, the bricks are much mangled where strength is wanted. Others again lay all heading courses within the outside Flemish bond, making the face alternately of 9 and of 4 inches in thickness. This, as far as relates to the splitting of the wall is an effectual preventative. But curing one evil another is increased, for here is no stretching bond, as the little that occurs in Flemish bond face-work is too trifling to be of any avail; so that the least inequality of settlement, or weight in the longitudinal direction of the wall, occasions a separation in the vertical joints, as may be often seen in the fronts of buildings. Even if longitudinal courses should be directed to be alte nately laid in the interior of th wall, there is little chance of succeeding better. The advantage of the old English over the Flemish bond is very satisfactoril pointed out in a small pamphle entitled "Observations on Bric Bond," to which we must ref the reader for further informatio on the subject.

In the winter it is very necessary to preserve the unfinishe wall from the alternate effects o rain and frost; for if it be exposed, the rain will penetrate int the bricks and mortar, and by bein converted into ice will expand and burst, or crumble the materials in which it is contained: consequently, as soon as the storm weather and frost set in, the unfinished walls should be covere either with straw or weathe boarding. When weather boarding is employed, it is advisable to have a good layer of straw between the work and the weather boarding; and to place the boarding in the form of stone coping, to throw the water off equally on both sides.

Bridge. A structure of carpentry, masonry, or iron-work, built over a river, canal, or valley, for the convenience of passing from one side to the other. bridge may therefore be considered as a road suspended in the ai by arches or lintels, which arches or lintels are supported by piers or abutments.

The extreme supports of a bridge, whether it have but one transverse aperture or a series of transverse apertures or arches are called the *butments*, or *abutments*; the parts between the apertures, which sustain the lintels or arches, the *piers*, or *pillars*; and the fences on the sides of the bridge-way, for preventing the passengers from falling into the water or valley below, the *parapets*. When a bridge is intended for both foot passengers and carriages, the middle part is appropriated to the *road*, or *carriage-way*; and on each side of this, a path is in general raised, and sometimes paved with flag-stones, for the foot passengers—these are called the *footpaths*, or *banquettes*.

The invention of bridges is doubtless of the highest antiquity; but there are no records now left that will enable us to trace it through its successive stages of improvement. In the rudest ages, bridges were probably formed by throwing single trees across small streams; and in case or broader streams, by fastening the roots of a tree on each bank, and twisting together their branches in the middle of the stream. Bridges of this kind must have frequently occurred by chance; and mankind by observing them may have been stimulated to adopt the same mode for their mutual accommodation; accordingly we find that Mr. Park found even the latter mode practised on rivers in the interior of Africa. Bridges of this kind will only answer for rivers of a limited width; consequently, in broader streams it became necessary to have recourse to other modes. One of these, for rapid streams, was, perhaps, the forming of ropes of rushes or the hides of cattle, and stretching them between trees or posts on the opposite banks. The following accounts, given by Don Antonia de Ulloa, will afford a distinct notion how these sort of bridges were constructed and used in the mountainous parts of South America. (See vol. ii. p. 164. London, 4th edition, 8vo.)

"Over the river Desaguadero is still remaining the bridge of rushes, invented by Capac Yupanqui, the fifth ynca, for transporting his army to the other side, in order to conquer the provinces of Collasuyo. The Desaguadero is here between eighty and a hundred yards in breadth, flowing with a very impetuous current, under a smooth, and as it were a sleeping surface. The ynca, to overcome this difficulty, ordered four very large cables to be made of a kind of grass which covers the lofty heaths and mountains of that country, and called by the Indians, icku; and these cables were the foundation of the whole structure. Two of these being laid across the water, fascines of dry juncia and tortora, species of rushes, were fastened together and laid across them. On these the two other cables were laid, and again covered with the other fascines securely fastened, but smaller than the first, and arranged in such a manner as to form a level surface; and by this means he procured a safe passage for his army. This bridge, which is about five yards in breadth, and one yard and a half above the surface of the water, is carefully repaired or rebuilt every six months, by the neighbouring provinces, in pursuance of a law made by that ynca, and since often confirmed by the kings of Spain, on account of its prodigious use; it being the channel of intercourse between those provinces separated by the Desaguadero."

Again: (vol. i. page 430.) "When the rivers are too deep to be forded, bridges are made at the most frequented places. Of these there are two kinds besides those made of stone, which are very few: the former of wood, which are most common, and the latter of bujucos. With regard to the first, they choose a place where the river is very narrow, and has on each side high rocks. They consist of only four long beams laid close together over the precipice, and form a path about a yard and a half in breadth, being just sufficient for a man to pass over on horseback; and custom has rendered these bridges so natural to them, that they pass them without any apprehension. The second, or those formed of bujucos, are only used where the breadth of the river will not admit of any beams to be laid across. In the construction of these, several bujucos are twisted together, so as to form a kind of large cable of the length required. Six of these are carried from one side of the river to the other, two of which are considerably higher than the other four; on the latter are laid sticks in a transverse direction, and over these branches of trees as a flooring; the former are fastened to the four which form the bridge, and by that means serve as rails for the security of the passengers, who would otherwise be in no small degree of danger from the continual oscillation. The bujuco bridges in this country are only for men, the mules swim over the rivers; in order to which, when their loading is taken off, they are drove into the water nearly half a league above the bridge that they may reach the opposite shore near it, the rapidity of the stream carrying them so great a distance. In the mean time, the Indians carry over the loading on their shoulders. On some rivers in Peru there are bujuco bridges so large, that droves of loaded mules pass over them; particularly the river Apurimac, which is the thoroughfare of all the commerce carried on between Lima, Cuzco, La Plata, and other parts to the southward.

"Some rivers instead of a bujuco bridge, are passed by means of a tarabita; as is the case with regard to that of Alchipichi. This machine serves not only to carry over persons and loads, but also the beasts themselves; the rapidity of the stream, and the monstrous stones continually rolling along it, render it impracticable for them to swim over it.

"The tarabita is only a single rope made of bujuco, or thongs of an ox's hide, and consisting of several strands, and about 6 or 8 inches in the thickness. This rope is extended from one side of the river to the other, and fastened on each bank to strong posts. On one side is a kind of wheel to straighten or slacken the tarabita to the degree required. From the tarabita hangs a kind of hammock, capable of holding a man; and is suspended by a clue at each end. A rope is also fastened to either clue, and extended to each side of the river, for drawing the hammock to the side intended. A push at its first setting off sends it quickly to the other side.

"For carrying over the mules, two tarabitas are necessary, one for each side of the river, and the ropes are much thicker and slacker. On this rope is only one clue, which is of wood, and by which the beast is suspended, being secured by girths round the belly, neck and legs. When this is performed, the creature is shoved off, and immediately landed on the opposite side. Such as are accustomed to be carried over in this manner, never make the least motion, and even come of themselves to have the girths fastened round them; but it is with great difficulty they are at first brough to suffer the girths to be put round their bodies, and when they find themselves suspended, kick and fling, during their short passage, in a most terrible manner. The river of Alchipichi may well excite terror in a young traveller, being between thirty and forty fathoms from shore to shore; and its perpendicular height above the surface of the water twenty-five fathoms."

Bridges of this description are doubtless the most simple, as also the best that men in an uncivilized state can construct for deep and rapid streams: but when the streams, though broad, are neither deep nor rapid, one still more simple may be contrived, by placing large stones in the water, at suitable distances apart, and laying other stones or beams of timber on them, so as to form a continued pathway over the stream. To these kinds of bridges, others of a similar nature but of greater utility succeeded when the arts began to be studied and known, consisting of piers composed of hewn stone, laid with or without mortar, and single stones or beams of timber stretched from pier to pier after the manner of the last mentioned. The bridge over the Euphrates at Babylon, appears to have been constructed in this manner; and there are many of a similar nature in different parts of China.

With respect to the next, and grand mode, that of constructing *arches* between the piers, it appears that the Chinese, (if we may credit their accounts,) contrived to form bridges in this manner, many centuries before arches were known to the inhabitants of the western world.

From the accounts generally given, it is not easy to form distinct ideas of the dimensions or constructions of the Chinese bridges, or to what extent they merit the appellation bestowed by travellers of being great and magnificent. Duhalde informs us, that "the stone bridges are commonly built like ours, on large piers of stone capable of resisting the rapidity of the stream, and sustaining the weight of the arches, wide enough for the passage of large vessels. They are exceedingly numerous, and the emperor spares no expense when the public good requires them to be built.

"Of these, there is one very remarkable at Foutchcou-fou, the capital of Toukien. The river over which it is built is half a league in breadth; it is sometimes divided into small arms, and sometimes separated by small islands; these are united in joining the islands by bridges, which make altogether eight furlongs, or Chinese lys, and seventy-six toises. The principal of these has alone above one hundred arches built of white stone, with bannisters on each side handsomely carved, upon which, at the distance of every 10 feet, are placed square pilasters, whose bases are very large, resembling hollow barks.

"But that which excels the rest is at Suentchcou-fou, built over the point of an arm of the sea, without which, the passage would be sometimes dangerous, even in a boat. It is 2500 Chinese feet in length, and 20 in breadth; it is supported by two hundred and fifty-two strong piers, one hundred and twenty-six on each side. All the stones are of the same bigness as well those which are laid from pier to pier, as those which are laid crosswise, insomuch that it is difficult to comprehend how stones of such an enormous size could be placed in such a regular manner, or even raised on the high piers on which they lie. After this there is nothing of the kind worth mentioning."

The only conclusion to be drawn from the foregoing description of this work, which excels all the rest, is, that two rows of large stones or piers (each row consisting of one hundred and twenty-six,) have been set up across the shallow mouth of a river or arm of the sea; thus along the top of these, other long stones have been laid horizontally, like wooden beams; and lastly that long stones have been laid crosswise upon these longitudinal beams, in the manner of joists in carpentry, or, more probably close together, composing a compact bed or roadway. By dividing 2500, the total length in Chinese feet, by 127, the number of openings, it gives nearly 20 feet between centre and centre of the piers,—so that after the thickness of the pier is taken away from the 20 feet, a moderate opening is left for the lintel to cover. The dimensions crosswise, correspond with the description as to the stones being the same size, (at least as to length;) for the breadth of the bridge is said to be 20 feet, and taking away the thickness of the two longitudinal beams, leaves the dimensions of the opening to be covered by the stones lying crosswise. It is therefore to the carrying from the quarry and raising stones of this magnitude, that the praise of ingenuity must be attributed; there being nothing else in the mode of construction which has a claim to refined science, or great progress in the mechanical arts. The danger to boats passing must no doubt have arisen from the shallowness of the water, and the frequency and violence of the surfs.

From the following relation, extracted from the same work, there is reason to expect correct information. It is entitled, "An account of the Journey of the Fathers Boures, Fontenay, Gorbellou le Compte, and Vesdelore, from the port of Ning Po to Pekin, with a very exact and particular description of all the places throughout which they passed, in the provinces of Tche-kiang, Kiang-nan, Chan-tong and Petcheli.

"It is in this agreeable place that the city of Chao-king has its situation. In the streets are a great number of canals, which give occasion for a great number of bridges. They are very high, and have generally but one arch, which is so slightly built towards the top, that carriages never pass over them, which makes a great number of porters necessary. They pass over these bridges by a kind of stairs, of very easy ascent, whose steps are not more than 3 inches in thickness. There are other sorts of bridges, made of stones 18 feet long, laid upon piles in the manner of planks. There are many of these over the great canal very handsomely built.

Again, "about four leagues from Hang-tcheou we crossed a village called Tan-si. It is built on both sides of the canal, on which are also two quays, about four hundred or five hundred geometrical paces in length. They are formed of the same freestone which lines the sides of the canal. There are stairs for the conveniency of every house, which are much better built, and more uniform than those in the city. In the midst of the village is a fine bridge of en large arches that in the iddle is 45 French feet wide ; rest diminish in proportion the descent of the bridge. ere are two or three great lges of one arch only.

" We crossed a great village or intry town, called Ovan-kiang- g of large extent. One part nmunicates with the other by ans of a bridge of three great hes very curiously built : the ddle arch is 45 French feet le, and 20 feet high."

Of these arches, which are here med large and great, we find span to be only 45 feet ; an tent which, in Europe, would t be honoured with those ap- llations. The Chinese arches e of various forms, pointed semi- cular, semi-elliptical, &c., and eir construction, as described Mr. Barrow, is very curious. " Each stone, from 5 to 10 feet length, is cut so as to form the gment of the arch, and in ch cases there is no keystone ; bs of wood fitted to the convex- y of the arch and bolted through e stones by iron bars, fixed fast to the solid parts of the bridge ; metimes, however, they are ithout wood, and the curved ones are mortised into long ansverse blocks of stone." Mr. arrow proceeds to observe, there are, however, arches herein the stones are smaller, nd pointed to a centre as in ours. have understood from the late aptain Parish, that no masonry ould be superior to that of the reat wall, and that all the arched nd vaulted work in the old owers was exceedingly well rned."

Among the ancients, the arch does ot appear to have been known ither in Egypt or India ; nor is ny trace of it to be met with in he ancient works of Persia or Phœnicia ; the Greeks also have a very doubtful claim to the knowledge of the arch. The first positive information that occurs in historians regarding the use of arches is given by Livy, who informs us that Scipio Africanus, and Lucius Mummius, placed arches on piers, which had been formed by M. Fulvius some years before that period, about one hundred years before Augustus Cæsar was placed in the empire. And Cicero, in his oration against Verres, mentions an arch, erected in honour of Verres, at Syracuse, " and so early an existence of such a kind of structure *there*, before we read of any thing like it any where else, may fairly lead us to suspect that Sicily was the country where this noble kind of ornament first appeared, and that, indeed, Archimedes was the inventor of it."

Hirtius describes arches at Alexandria ; Livy also particularizes a street called the *archway* at Rome ; and Virgil has a plain reference to arches in some of his ideal descriptions and similes ; yet all these were after the era of Archimedes.

However doubtful the claim to the invention of the arch may be, we know, from the best historical evidence, that the Romans were the first who applied it generally to useful purposes ; such as in the construction of aqueducts and bridges, and in the vaulting of magnificent temples.

The bridges of the ancient Romans seem to have possessed all the requisites which are met with in those of modern times. They consisted of piers, arches, and abutments ; and had roads over the middle for carriages, and on each side, footpaths or banquettes for the accommodation of passengers. The footpaths were raised above the carriage-way, and were divided from it by a railing; and sometimes were covered over, as in the Pons Ælius, to shelter the passengers from the rain.

The ancient bridges of Rome, as described by Gautier, were eight in number. 1. Pons Ælius, built by the emperor Adrian, and named after him. It is said to have once had a cover of bronze supported by forty-two columns. It is now called Sancto Angelo.

2. A triumphal bridge, the ruins of which are now seen in the Tiber. Over this bridge the emperors and consuls passed when they were decreed a triumph.

3. Pons Janiculenses, now Ponto Sixtus, it having been rebuilt by pope Sixtus IV. in 1745.

4. Pons Cestius, at present St. Bartholomew. It was rebuilt by the emperor Valentinian.

5. Pons Fabricius, now Ponto Caspi.

6. Pons Senatorius, at present Sancta Maria.

7. Pons Horatius formerly Sublicius, built of stone by Horatius Cocles, and rebuilt by Emilius Lepidus. The ruins of this bridge are still to be seen in the Tiber.

8. Pons Milvius, which is about two miles out of Rome upon the Flaminian way.

Besides these, the Romans constructed many other bridges, some of which were very magnificent. One built by Augustus, near Narni, on the road from Rome to Loretto, consisted of four arches, the span of the first being 75 feet and 102 feet high, and the spans of the others 135, 114, and 142 feet: another, that of Merida, upon the river Guadiana, is, according to don Antonio Pouz, 1300 paces in length, and according to Vargas, contained sixty-four arches; but, in the time of Philip III., one of tl large arches towards the midd was destroyed by an inundatio on which account three or fo adjoining were rebuilt in 161 The most magnificent of all tl Roman bridges is, perhaps, th of Alcantara upon the Tagus. consists of six arches: its who length is 670 Spanish feet, ar from the bottom of the river t the roadway the height is 20 feet.

Beside the bridges we have en umerated, the Romans construc ed many others which are eith still existing, or have been co rectly described to us. Accoun also have been handed down t us of other bridges, constructe for the temporary purposes war, as that of Darius upon th Thracian Bosphorus, Xerx upon the Hellespont, Pyrrh upon the Adriatic Gulph, Cæs upon the Rhine, and Trajan upo the Danube.

The building and repairing the Roman bridges was intruste first to the priests, who we named *pontifices*, then to the ce sors and curators of the road and lastly, the emperors took th management of the bridges in their own hands.

After the destruction of th Roman empire, and when the ar began to revive in Europe, a regular order of hospitallers wa founded by St. Benezet, an enthusiast, under the denominatio of pontifices or bridge-builder St. Benezet and his brethren constructed the bridge of Avignon composed of eighteen arches, an about 1000 yards in length. was begun in the year 1176, an finished in 1188. During th contentions of the popes, in 1385 some of the arches were destroyed; three others fell, for want o repairs, in 1602; and the destruc

of the bridge was completed
670, by large masses of ice,
ch floated down the river after
vere frost.

he city of Venice has nearly
hundred handsome bridges
tone of one arch, and of var-
sizes, over the canals, &c.
chief of these, called the
lto, erected after a design of
hael Angelo Buonarrotti, was
sidered at the time of its erec-
a masterpiece of art. It
sists of a bold flat arch, nearly
feet in span, and only 23 feet
n above the water; and was
structed in 1588 to 1591.
breadth of the bridge, which
3 feet, is divided by two rows
hops into three narrow streets,
t in the middle being the
lest; and there is in the centre
open archway, by which the
ee streets communicate with
another. At each end of the
dge is an ascent of 56 feet, and
prospect from its summit is
th lively and magnificent. The
ole exterior of the shops and
the bridge is marble. The
undation extends 90 feet, and
sts upon twelve hundred elm
les. This structure cost the
public two hundred and fifty
ousand ducats.

One of the most magnificent of
e aqueduct bridges hitherto
onstructed is that of Alcantara,
ear the city of Lisbon. It was
ommenced in the reign of John
., king of Portugal, in the year
713, and was finished the 6th of
ugust, 1732, under the super-
ntendence of the brigadier Man-
el de Maya. The aqueduct com-
nences at a spring near the
iberia de Caranque, about three
eagues and a half from Lisbon;
nd the water is conveyed thence
hrough subterraneous passages in
he hills, and through a magnificent
ange of arches suspended over the vallies by means of very high piers, for the use of the inhabitants of the city of Lisbon, and those of the villages adjacent. When the water emerges from its subterraneous passage, it is conveyed along the top of the arches by two channels, of the depth of 12 inches each; but it generally flows at a depth of about 7 inches, yielding an abundant and never-failing supply. The interior height of this building is about 13 feet; and through the centre, between the streams, is a wide handsome footpath, paved with freestone. The building is continued the same height and width through the whole of the aqueduct from the spring to Lisbon; so that if by accident any part becomes out of repair, the workmen can have easy access to it. The subterraneous passages are lighted and ventilated by excavations made from the surface of the hills, through which they pass to the aqueduct; and over each of the openings thus made, turrets or square towers are erected, having apertures, latticed with iron bars, to admit the light and air, and at the same time to prevent mischievous persons from throwing any thing into the aqueduct to injure it. These turrets are sixteen in number, and 16 feet square, and rise 23 feet 6 inches above the roof. The windows, or apertures, for the admission of light and air, are 3 feet 7 inches long, by 13 inches wide. Beneath every second turret is an arched doorway into the aqueduct, on each side of the building wherein the water flows, and between that building and the parapet wall is a footpath, leading from Lisbon towards the very pleasant village of Bemsique, about four miles distant, where several gentlemen have their quintas, or country-

seats. The water channel under the grand arch is 24 feet in width, and 7 feet in depth, but no water passes through it, except in very rainy seasons: the small stream, continually passing through the vale of Alcantara, is conveyed by means of a very narrow channel, under the pavement beneath the grand arch, and then continues its course through the valley, in a stream between 2 and 3 feet wide, until it empties itself into the Tagus at Alcantara bridge, at the distance of about two miles from the aqueduct. This remarkable structure consists of thirty-five arches, of various dimensions. The eighth, which is the grand arch, is 108 feet 5 inches wide, and 227 feet high: and the total length of the piers and arches is 2464 feet. The expense attending the execution of so magnificent a work, and keeping the same in repair, though immense, has hitherto been defrayed by the small tax of a single rey on every pound of butcher's meat sold in the markets of Lisbon.

In France, besides the bridges of Pont du Garde, near Nismes, and St. Esprit, near Lyons, constructed by the ancient Romans, there are several remarkable for their size and boldness of construction. Among these may be mentioned the bridge of Neuilly, built by M. Perronet, over the Seine, on the alignment of the grand avenue of the Champs Elysées, in front of the palace of the Thuilleries. This bridge, which is level on the top, consists of five equal arches, of 120 feet French, which is equal to 128 English feet, in the span, and 30 feet French, which is equal to 32 feet English in the rise. The arches are elliptical, composed of eleven arcs of circles of different diameters; thus the upper portion of the arc was formed with a circle of 16 feet radius, which, by its settlement during the building an after the striking of the centres was flattened, till it became a arc of a circle of 259 feet radius differing so little from a platband that, as Perronet observes, th rise of the curve in a lengt of 33 feet, amounted only to inches 9 lines. The piers are 1 feet wide, and the breadth of th bridge is 48 feet. It was begu in the year 1768, and finishe in 1780.

At Nantes is a bridge over th Seine, consisting of three arches that in the centre having an opening of 120 feet French, which is as we have stated above, equa to 128 feet English; and that o each side 108 feet French, whic is equal to 116 feet English. Th piers of this bridge are 25 feet 6 inches wide, and the abutments 29 feet. It was begun by M. Hupeau in 1757, and completed by Perronet.

On the river Oise, on the great road from Paris into Flanders, is the bridge of Pont-Sainte-Maixence, which is also the work o Perronet. It is 41 feet wide; and has three arches of 77 feet opening, each being a segment o a circle described with a radius o 118 feet. Each pier is singularly composed of four cylindrical pillars 9 feet diameter, leaving, therefore, three spaces of inter columniations between them, which are arched over, the two external ones closed with a thin walling, and the middle one left open.

The bridge over the Loire, at Orleans, is composed of nine arches, which spring at 12 inches above low water. The middle arch is 106 feet in span, with a rise of 30 feet, the two arches at he extremities 98 feet wide and 6 feet high; and the others in roportion. The four middle piers re 19 feet, the four others 18 eet, and the abutments 23 feet inches thick, making the whole ngth 1100 feet; the arches are val, described from three centres. his bridge was built by M. Hueau, and was begun in 1750 and nished in 1760.

There is another bridge built pon one of the arms of the oire, at Saumar. It was designd by M. de Voglio, and executed y L. A. de Cessart. This bridge onsists of twelve elliptical arches, ach having a span of 60 feet, nd a rise of 21 feet: the piers re 12 feet thick, and the breadth f the bridge, including the paraets, is 42 feet French, or 42 feet inches English. It was begun n 1756, and finished in 1770.

The progress of bridge buildng in England seems to have ept pace with the same art on he continent. The most ancient tructure of this kind now remaining entire is the triangular othic bridge at Croyland, in Lincolnshire. It is said to have been uilt in the year 860, which date s most likely correct, for Croyland bbey was founded in 716, and the bbey of Rumsey, in Huntingdonhire, in 974. It is formed by hree semi-arches, whose bases tand in the circumference of a ircle, equidistant from each other, nd uniting at the top. The riune nature of the structure has led some to suppose that it was intended as an emblem of he trinity, which is not improbable, considering the age in which it was constructed. The ascent on either side of the semiarches is by steps, paved with small stones, and is so steep that none but foot passengers can go over the bridge; horsemen and carriages frequently pass under it, as the river is but shallow. This singular structure which appears to have been built less with a view to utility than to that of boldness and originality of design, still exhibits no symptoms of decay.

London-bridge was first built with timber in the reign of Ethelred, between the years 993 and 1010; and it was repaired, or rather rebuilt, in 1163. The present stone bridge was begun in 1176, under king Henry II., and finished under king John in the year 1209: and it is worthy of remark, that the bridge of Avignon was begun by St. Benezet in the same year that Peter of Colchester, a priest, began to build London-bridge of stone. This bridge, which is in the old gothic style, had formerly twenty small locks or arches; but there are now only nineteen, as two arches have been converted into one in the centre. The length of this bridge is 940 feet, its height 44 feet, and there is a clear width of 47 feet between the parapets. The piers are from 15 to 35 feet thick, with enormous sterlings projecting at each side; so that when the tide is above the sterlings the greatest water-way is but 545 feet, scarcely half the breadth of the river; and when the tide is below the sterlings, the water-way is reduced to 204 feet, which causes a dangerous fall of water. During many centuries, houses were on each side of the bridge; but these were removed, the avenues to the bridge were enlarged, and two arches were thrown into one, in 1758. The repairs amounted to upwards of eighty thousand pounds; but, notwithstanding this expenditure, the bridge is in so dilapidated a condition that a new bridge has been resolved on, and is now in the progress of construction under the inspection of the Messrs. John and George Rennie. Of this we shall speak more at large under the subhead, *Practice.*

Other bridges in England were built in the manner of London-bridge; as that of Rochester, which is 550 feet long, and has eleven arches; and that till lately at Newcastle-upon-Tyne, which was broken down by a great flood in the year 1771. The longest bridge in England is that built by Bernard, abbot of Burton, over the Trent, at Burton, in the twelfth century. It is all of squared freestone, and is strong and lofty, 1545 feet in length, and consists of thirty-four arches.

In 1636, Inigo Jones gave a design for a bridge, which was afterwards erected at Llanwst, in Denbighshire. It consists of three arches, segments of circles. The middle arch is 58 feet span, and has a rise of 17 feet. The piers are 10 feet thick; and the breadth of the soffit of the middle arch is 14 feet. This bridge has a very light appearance.

One of the most extraordinary of the bridges in Great Britain is that over the river Taaf, near Llantrissent, in Glamorganshire, called in Welsh, *Pont y ty Prydd.* It is the work of William Edwards, an uneducated mason of the country, who was only indebted for his skill to his own industry and the power of his genius. He had engaged, in 1746, to build a new bridge at this place, which he executed in a style superior to any thing of the kind in this or any other part of Wales, for neatness of workmanship and elegance of design. "It consisted," says Malkin, in his "Tour in South Wales," "of three arches, elegantly light in their construction. The hewn stones were excellently well dressed and closely jointed. It was admired by all who saw it. But this river runs through a very deep vale that is more than usually woody, and crowded about with mountains. It is also to be considered, that many other rivers of no mean capacity, as the Crue, the Bargoed Taaf, and the Cunno, besides almost numberless brooks that run through long, deep, and well wooded vales or glens, fall into the Taaf in its progress. The descents into these vales from the mountains being in general very steep, the water in long and heavy rains collects into these rivers with great rapidity and force, raising floods, that in their descriptions would appear absolutely incredible to the inhabitants of open and flat countries, where the rivers are neither so precipitate in their courses, nor have such hills on each side to swell them into torrents. Such a flood unfortunately occurred after the completion of this undertaking, which tore up the largest trees by the roots, and carried them down the river to the bridge, where the arches were not sufficiently large to admit of their passage. Here, therefore, they were detained. Brushwood, weeds, hay, straw, and whatever lay in the way of the flood, came down and collected about the branches of the trees that stuck fast in the arches, and choked the free current of the water. In consequence of this obstruction to the flood, a strong and thick dam, as it were, was thus formed. The aggregate of so many collected streams being unable to get any further, rose here to a prodigious height, and with the force of its pressure, car-ed the bridge entirely away be- re it. William Edwards had iven security for the stability of e bridge during the space of even years; of course he was bliged to erect another, and he roceeded on his duty with all ossible speed. The bridge had ly stood about two years and a alf. The second bridge was of e arch, for the purpose of ad- itting freely under it whatever cumbrances the floods might ing down. The span or chord f this arch was 140 feet, its alti- de 35 feet, the segment of a rcle whose diameter was 170 et. The arch was finished, but e parapets not yet erected, when ch was the pressure of the un- voidable ponderous work over e haunches, that it sprung in e middle, and the keystones ere forced out. This was a evere blow to a man who had itherto met with nothing but isfortune in an enterprise which as to establish or ruin him in is profession. William Edwards, owever, possessed a courage hich did not easily forsake him; e engaged in it a third time, and y means of cylindrical holes hrough the haunches, so re- uced their weight, that there as no longer any danger from t. The second bridge fell in 751; the third which has stood ver since, was completed in 755." The present arch is 140 eet in span, and 35 feet high, eing a segment of a circle of 75 feet diameter. In each haunch here are three cylindrical open- ngs running through from side o side; the diameter of the low- est is 9 feet, of the next 6 feet, nd of the uppermost 3 feet. The width of the bridge is about 11 feet. To strengthen it horizontally it is made widest at the abutments, from which it contracts towards the centre by seven offsets, so that the roadway is 1 foot 9 inches wider at the extremities than at the middle.

The bridge over the river Thames, at Westminster, was constructed by Mr. Labalye. It is 1220 feet long and 44 feet wide, having a commodious footpath, 7 feet broad, on each side. It consists of thirteen large and two small arches, fourteen intermediate piers, and two abutments. The length of each abutment is 76 feet; the opening of each of the smaller arches is 25 feet; the span of the first of the larger arches, one being at each end, adjoining the smaller arches, is 52 feet; of the next, 56 feet; and so on progressively, increasing 4 feet at a time, to the centre arch of which the span is 76 feet. The piers of the middle arch contain each 3000 cubic feet, or near two hundred tons of solid stone, and are each 17 feet thick; the others decrease equally 1 foot on each side; every pier terminating with a saliant right angle against the stream. The arches are semicircular, and spring from about the height of 2 feet above low water mark, leaving a free waterway of 870 feet. The footway is adorned with semi-octangular towers over every pier, which afford passengers commodious shelter from a shower of rain. This bridge was begun in 1738, the centre of the last arch was struck on the 25th of July, 1747, and on the 14th day of November of the same year the roads and streets were finished. A circumstance, however, occurred, which prevented the bridge from being opened to the public till the expiration of three years. Some workmen, who were employed to get gravel out of the bed of the river to cover the roadway of the bridge, finding some very suitable near the third pier on the western side of the centre arch, excavated considerably lower than the foundation of the pier, and too near it; the consequence was, that gravel run from under the platform, and the pier sunk so much as to render it necessary to take down the two arches that rested upon it. The securing the foundation, rebuilding the pier and two arches, and replacing the parapets, pavements, and roadways, occupied the space we have mentioned, and the bridge was not opened to the public till the 18th of November, 1750. By some this bridge has been spoken of in terms of the highest praise; but others complain that the arches are too small in proportion to the quantity of masonry.

The piers of Westminster-bridge were laid by means of caissons, of which we shall take notice under the subhead, *Practice*. The building of the bridge, &c. amounted to the net expense of £218,800.

About ten years after the completion of Westminster-bridge, another handsome stone structure was thrown over the Thames, near the centre of the city of London. This structure, now generally known by the name of Blackfriars-bridge, was planed and built by the late Mr. Robert Mylne, between 1760 and 1771, the building occupying a term of ten years and three quarters. This bridge is from shore to shore, 995 feet in length, and 42 feet 6 inches in width, and has nine elliptical arches. The centre arch is 100 feet in width, and the four arches on either side decrease gradually towards the shore, being 98, 93, 83, and 70 feet respectively, leaving a clear waterway of 788 feet. The upper surface of the bridge forms the segment of a very large circle, guarded on each side with an elegant open stone balustrade; and, whether viewed from the water or from the shore, has a very fine appearance. Over each pier is an open recess or balcony supported by two slender ionic columns and pilasters, which rest on a circular projection from the pier, above high water mark. Each extremity of the bridge is rounded off to the right and left, in form of the quadrant of a circle, which renders the access commodious and agreeable. The cost of erection amounted to £152,840.

In erecting this edifice Mr. Mylne benefited by the example of Labalye; and the general design of the bridge bespeaks a mind emboldened by the success of his predecessor, to advance, though very cautiously, a step further in the practice of bridge-building. The piers being proportionally less thick, and the arches wider and of an elliptical form, with less masonry upon them, give this bridge a much lighter appearance than that of Westminster, though it has been doubted, whether the slender detached ionic columns are a proper accompaniment to such a work, and whether the divisions of the length of the rusticated headers of the arches are any improvement.

In the interval between the completion of Blackfriars-bridge and the commencement of that noblest of structures, Waterloo-bridge, many very neat and elegant bridges have been erected in different parts of Great Britain and Ireland. Of these we shall briefly mention the Tees, at Winston, in Yorkshire, consisting of a single arch of 108 feet 9 inches span, designed by sir Thomas Robinson; one over the Tweed at Kelso, consisting of five elliptical arches, each of 72 feet span, erected under the direction of Mr. John Rennie; the aqueduct bridge on the river Lune, at Lancaster, consisting of five arches, each of 70 feet span; designed by the same eminent engineer. Essex-bridge over the Liffey, designed and built by Mr. George Semple, consisting of five arches: one of the span of 58 feet, another of 37 feet, and three of 45 feet. Sarah's-bridge, constructed by Mr. Stevens, having an arch of 110 feet span, with a rise of 22 feet, also over the river Liffey. Another bridge over the same river, called Carlisle-bridge, consisting of three arches, the middle being 50 feet in span, and the other two 40 feet each· one of a single arch of 130 feet span, built at Aberdeen, from a design by Mr. Telford: another by the same eminent engineer, upon the river Dee, having an arch of the span of 118 feet, and the rise or versed sine 38 feet: one by Mr. G. Burn, over the river Spey, near Gordon Castle, at Fochabars, consisting of four arches, the two middle ones being 95 feet span, and the breadth over the parapets 21 feet 6 inches: and that built by the duke of Athol over the river Tay at Dunkeld, from a design by Mr. Telford, consisting of five large arches, and two smaller land arches, the middle arch being 90 feet span, with a rise of 30 feet, and the width over the parapets 27 feet 6 inches.

Waterloo-bridge, thrown over the river Thames, at London, was projected by Mr. George Dodd, about the year 1805. Considerable time, however, elapsed before the ultimate arrangements necessary to carry it into execution were made. The first act was obtained in the month of June, 1809, and incorporated the proprietors under the name of the "Strand-bridge Company," empowering them to raise the sum of 500,000*l.* in transferable shares of 100*l.* each; and the further sum of 300,000*l.*, by the issuing new shares, or by mortgage, in case it should be found necessary. In July, 1813, a second act was passed, enabling them to raise an additional sum of 200,000*l.*; and in July, 1816, a third act was obtained, granting the company further powers, and changing the name from the Strand-bridge to Waterloo-bridge, which name it now bears.

Mr. Rennie, having been appointed engineer to the company, on the 23d day of June, 1810, furnished two designs, one of seven and the other of nine arches, the latter of which was finally approved by the committee, and ordered to be put in execution.

This noble bridge is situate about half way between the bridges of Blackfriars and Westminster. The river at this place is about 1,326 feet wide at high water; and ordinary spring tides rise about 13 feet, and ordinary neap tides about 9 feet 6 inches. The greatest depth at low water is about 9 feet. The bed of the river is composed principally of a stratum of sand and gravel resting upon clay.

The bridge is level, and consists of nine semi-elliptical arches, each having a span of 120 feet, and a rise of 35 feet; thus leaving for the navigation 30 feet of clear height above the high water of spring tides, and forming an ample water-way of 1,080 feet. The abutments are 40 feet thick at the bases, and diminish to 30 feet at the springing of the arches. Their lengths, including the stairs, are 140 feet. The piers are 30 feet broad at the base, and diminish to two-thirds at the springing of the arches. Their lengths at the bases are 87 feet. The points, or saliant angles, of the piers are in the form of a gothic arch, and are terminated above by two three-quarter columns supporting an entablature which forms a recess. The whole is surmounted with a balluster, and a frieze and cornice of the Grecian doric. The columns are doric also, and were selected on account of the extraordinary strength of their proportions, as being best suited to a structure of this magnitude; they are 23 feet 9 inches high, or rather more than four diameters.

The clear width between the parapets is 42 feet 4 inches; allowing 28 feet 4 inches for the carriage-way, and 7 feet for each of the footpaths.

Four plying places, or stairs, for watermen, are formed by circular wings, projecting at right angles to the bridge, with archways leading to the roadway. These wings are ornamented with columns, entablatures, &c. as before described.

The bridge being level, and of so great a length, it became necessary to provide means for carrying off the rain-water. This is effected by having circular openings in the centre of each pier, which enter the river immediately below low-water mark: these openings are connected with iron branch pipes up to the level of the roadway, where gratings are placed to receive the water.

The roads or approaches to each end of the pier are 70 feet wide throughout, except just a the entrance into the Strand, an are carried over a series of semi circular brick arches of 16 fee span each. The Surrey or sou thern approach is formed b thirty-nine of these, besides a elliptical arch of 26 feet span over the narrow wall road, and small embankment about on hundred and sixty-five yards long having an easy and gradual ascen of not more than 1 foot in 3 feet.

The length of the brick arches in the Surrey approach is	766 feet.
Ditto of those in the Strand approach . .	310 feet.
Total length of the bridge from the ends of abutments . . .	1,380 feet.
Total length of the bridge and brick arches	2,456 feet.

The bridge now being constructed over the Thames, in lieu of the old London-bridge, is under the direction of Messrs. Rennie, and will consist of five arches. See the sub-head *Practice.*

Iron bridges appear to be the exclusive invention of British artists. The first bridge of this kind upon a large scale is that erected by Mr. Abraham Darby, in the year 1779, over the river Severn, at Coalbrookdale. It consists of a single arch of 100 feet 6 inches span, and the whole of the iron in it weighed one hundred seventy-eight and a half tons. The second iron bridge was constructed by Messrs. Walker of Rotherham, for Mr. Thomas Paine, of political notoriety, and was intended by him to be sent to America; but he being unable to defray the expense, Messrs. Walker took the arch to pieces, and afterwards employed some of the materials in the bridge of which we shall next take note. The third iron bridge, and that in which some of the materials above alluded to were used, was executed on the river Wear, at Sunderland, by Rowland Burdon, Esq. M. P. for the county of Durham, by the assistance of Messrs. Walker, the founders, Mr. Wilson, and several other persons. This bridge was begun in the year 1793, and completed in August, 1796. The stone abutments are 70 feet high, above the ordinary surface of low water in Sunderland harbour, to the spring of the arch. The iron arch is 236 feet span; and the springing stones project about two feet beyond the face of the masonry: so that the whole span, from abutment to abutment, is 240 feet. The versed sine of this arch is 30 feet: its soffit is therefore 100 feet from the surface of low water in Sunderland harbour. The weight of iron in this bridge is two hundred and fifty tons; two hundred and ten tons of cast, and forty tons of wrought iron. The fourth iron bridge that has been executed, is that over the river Severn, at Buildwas, about two miles distant from Coalbrookdale. It was begun in the year 1795, and finished in 1796, under the direction of Mr. Thomas Telford. The arch of this bridge is 130 feet span, with a versed sine of only 17 feet; and its width is but 18 feet to the outside.

About the same time as the bridge at Buildwas was erected, an iron bridge was thrown over the river Teme in Herefordshire; but its parts were so slender, and so ill-disposed, that, when the wooden centering was taken from under it, the whole gave way, and tumbled into the river. In the same year also as the bridge at Buildwas was begun, another was erected over the river Parret, at Bridgewater, by the Coalbrookdale company. The arch of this bridge is an ellipsis of 75 feet span, with a rise of 23 feet.

From this period till about the year 1808, few iron bridges of note were constructed. In the latter period, however, the stone bridge erected over the Thames, at Staines, gave way; and the magistrates of Middlesex and Surrey came to a resolution to have an iron bridge erected there, on the abutments of the late stone bridge, the piers of which only had given way. Mr. Wilson, who was the agent of Mr. Burdon, and employed for the purpose, undertook the construction of an iron arch of 181 feet span, with 16½ feet rise or versed sine: the arch being the segment of a circle. We must here observe, that an iron arch in small blocks, is not set up after the manner of a stone one, by beginning at the abutments, and building upwards, but is begun at the top, and continued downwards; it being easier to join the stone to the iron, than to cut the iron at the top, if it should not fit. It is therefore somewhat remarkable, that when these ribs were put together, and before they joined the masonry, it was so nicely balanced, and its parts were so firmly locked together, that after all the supports were taken out, except those next the abutment, the whole was moved by a man, by applying a crow-bar under the top; and it seemed to have but little tendency to push the abutments asunder. This, however, turned out unfortunately not to be the case. The centering was taken away, and the bridge was opened for the use of the public, about the end of the year 1801, or beginning of 1802. The bridge at first seemed to stand firm, and the public were delighted with its light and elegant appearance. But in a short time it was found that the arch was sinking; and soon afterwards it went so much, that it was found necessary to shut the new bridge up, and open the old one again. The sinking of the arch broke several of the transverse frames, and many of the radii at the haunches, which left no doubt that the abutments had given way. But on examination there appeared no visible sign of such fracture: there was not a crack in the masonry, nor had either of the abutments gone out of upright. After much investigation it was discovered, that the whole of the masonry of the abutments, to the very foundations, had slidden horizontally backwards, still preserving the perpendicular or upright position. The failure took place in the south abutment, which was supposed to be owing to a cellar that had been made in it. The inhabitants of Staines, therefore, by the advice of an engineer, whom they had consulted, had this abutment strengthened; but no sooner was this accomplished than the north one failed: this, also, it was their intention to have strengthened, but their funds being nearly exhausted, they finally resolved to take a considerable portion of the iron-work away, and to support the remainder by wooden piers. Before this bridge was completed, another was begun on the same principle, and of the same dimensions, over the river Tees, at Yarm. When finished, this bridge, instead of gradually yielding, as Staines had done, suddenly gave way, and tumbled into the river.

These disastrous circumstances may be principally attributed to the injudicious manner in which those bridges were constructed; and not to any deficiency in the material. An idea having gone forth among practical builders, that the lateral pressure of iron bridges, in consequence of their parts being so firmly bound together, is comparatively small to that of stone arches. On due consideration, however, Dr. Hutton supposes that this opinion will be found erroneous, and that an iron arch, of the same weight as one of stone, requires much stronger abutments to resist its lateral pressure and push, than the stone arch does. He accounts for it thus:—stone may, in a great measure, be considered as an unelastic substance, being very little subject to expansion or contraction. When, therefore, an arch is composed of this material, and the abutments are sufficiently strong to support it, when left to itself, there is little probability of its failure. No ordinary load upon it will excite a tremulous motion, nor will it change by heat or cold. The lateral pressure on the piers or abutments is therefore uniform.

But iron is an elastic substance, and is greatly affected by heat or cold, expanding with the one, and contracting by the other. When, therefore, a heavy load acts upon an iron bridge, such as a loaded waggon, the whole is put in motion, and the arch vibrates like the string of a violin, contracting and expanding while its parts are in the act of vibration. Thus at one part of the vibration it pulls the abutments together, and at the other it pushes them asunder, with a force compounded of the quantity of matter in motion, and the velocity with which it moves. When it expands, the whole weight of the arch is raised, and the pressure on the abutments is compounded of the velocity and matter of the weight raised. No such pressure, or rather impulsive momentum, takes place in a stone bridge: therefore the strength of the abutments of an iron bridge should be such as not only to sustain the weight of the arch, but also the additional push arising from the causes above stated. The abutments of Staines-bridge were only 14 feet thick; whereas they ought to have been at least 25 feet. There were also other causes which contributed to the failure of this bridge, such as the improper manner in which the foundations were made. The abutments of Yarm-bridge were made still weaker than those of Staines: no wonder, therefore, that its failure was more sudden.

Another cast-iron bridge, designed by Mr. Rennie, has been thrown over the Witham, at Boston, in Lincolnshire. Its span is 86 feet, and its versed sine only 5½ feet. Two others have been erected over the river Avon, at Bristol, in the years 1805 and 1806, under the direction of the Messrs. Jessop. These two bridges are fac-similes of each other; the arch of each being 100 feet span, the versed sine 15 feet, and the width of each bridge about 31 feet. The whole is of cast-iron, of the strongest grey metal, and each weighs one hundred and fifty tons.

An iron bridge has been erected by Mr. Telford over an arm of the sea at Bonar, in Sutherlandshire, North Britain. It presents an arch whose chord is 150 feet, and its versed sine 20 feet. The Union-bridge, over the river Conway, between Pentre Foelas and Bettws, in Denbighshire, is a handsome iron bridge, of one arch, the curve of which is the segment of a circle. It was constructed in 1815.

The iron bridge thrown over the Thames at Vauxhall, London, consists of nine arches of equal span, raised upon stone piers that were originally intended to support stone arches. It was executed under the direction of Mr. James Walker, the engineer. But the most splendid cast-iron bridge that has yet been erected, is that thrown over the Thames, at the bottom of Queen street, Cheapside, London, and known generally by the name of Southwark-bridge. It was designed and executed by that able and scientific engineer, Mr. Rennie, of whom we have had occasion to speak more than once; and consists of three arches, the chord of the middle arch being 210 feet, its versed sine 24 feet, and the height of the frame-work of the arch at the vertex 6 feet. The iron-work was cast by Messrs. Walker and Yates, late of Rotherham, in Yorkshire, and is supported by piers of granite.

The bridge of Austerlitz, over the Seine, at Paris, is also a much admired specimen of the science. The length of its chord is 106 feet, its versed sine only 10 feet 6 inches, and the height of the frame-work of the arch at the vertex, 4 feet 10 inches. It is the work of M. La Mande.

Two other arches of much larger dimensions have been proposed, but not executed. The boldest was projected by Mr. Telford, about the year 1800, and was intended to have supplied the place of the old London-bridge. The length of the chord of this immense arch was 600 feet, and its versed sine 65 feet.

The other proposed large iron bridge was by Wiebeking; the chord of which measures 292 feet, its versed sine 29 feet, and the height of the frame-work of the arch at the vertex, 3 feet 9 inches.

Iron suspension bridges were in use in Europe at the time of Scamozzi, as may be seen in his *Del Idea Archi*, 1615; but the knowledge requisite to determine the properties of this kind of bridge was not published till the time of Bernouilli. Ware, in his excellent tracts on vaults and bridges, says, that the pendent bridges mentioned by Scamozzi, were probably constructed on false principles, and consequently being of short duration, the invention fell into disrepute.

Suspension bridges are described as existing in various parts of Asia, Africa, and America, before this species of construction began to be practised in Europe. The first chain-bridge erected in England is supposed to be that over the Tees, forming a communication between the counties of Durham and York; but the description of this, as also of several others, we shall take leave to transcribe, from a very able article, by Robert Stevenson, Esq. F. R. S. E. and civil engineer, as inserted in the "Edinburgh Philosophical Journal," October, 1821.

The Winch-bridge, says Mr. Stevenson is noticed, and an elevation of it given in the third volume of Hutchinson's "Antiquities of Durham," printed at Carlisle, in 1794. As this volume is extremely scarce, owing to the greater part of the impression having been accidentally destroyed by fire, the writer of this article applied for a sight of it from the library of his friend, Mr. Isaac Cookson, of Newcastle-upon-Tyne. The following account is given by Hutchinson, at p. 279. "The environs of the river Tees abound with the most picturesque and romantic scenes; beautiful falls of water, rocks, and grotesque caverns. About two miles above Middleton, where the river falls in repeated cascades, a bridge, suspended on iron chains, is stretched from rock to rock, over a chasm near 60 feet deep, for the passage of travellers, but particularly of miners: the bridge is 70 feet in length, and little more than 2 feet broad, with a handrail on one side, and planked in such a manner, that the traveller experiences all the tremulous motion of the chain, and sees himself suspended over a roaring gulf, on an agitated and restless gangway, to which few strangers dare trust themselves." We regret that we have not been able to learn the precise date of the erection of this bridge, but, from good authority, we have ascertained that it was erected about the year 1741.

It appears, from a treatise on bridges by Mr. Thomas Pope, architect of New York, published in that city in the year 1811, that eight chain-bridges have been erected upon the catenarian principle, in different parts of America. It here deserves our particular notice, however, in any claim for priority of invention with our transatlantic friends, that the chain-bridge over the Tees was known in America, as Pope quotes Hutchinson's vol. iii., and gives a description of Winch-bridge. It further appears from this work, that a patent was granted by the American government, for the erection of bridges of suspension, in the year 1808. Our American author also describes a bridge of this construction, which seems to have been erected about the year 1809, over the river Merrimack, in the state of Massachusets, consisting of a catenarian arch of 244 feet span. The roadway of this bridge is suspended between two abutments or towers of masonry, 37 feet in height, on which piers of carpentry are erected, which are 35 feet in height. Over these ten chains are suspended, each measuring 516 feet in length, their ends being sunk into deep pits on both sides of the river, where they are secured by large stones. The bridge over the Merrimack has two carriage-ways, each of 15 feet in breadth. It is also described as having three chains, which range along the sides, and four in the middle, or between the roadways. The whole expense of this American work is estimated to have been twenty thousand dollars, and the bridge calculated to support or carry about five hundred tons.

Perhaps the most precarious and difficult problem ever presented to the consideration of the British engineer, was the suggestion of some highly patriotic gentlemen of Liverpool, for constructing a bridge over the estuary of the Mersey, at Runcorn Gap, about twenty miles from Liverpool. The specifications for this work provided that the span of the bridge should measure at least 1000 feet, and that its height above the surface of the water should not be less than 60 feet, so as to admit of the free navigation of this great commercial river. The idea of a bridge at Runcorn, we believe, was first conceived about the year 1813, when the demand for labour was extremely low, and a vast number of the working classes of Lancashire were thrown out of employment. A variety of designs for this bridge were procured by a select committee of the gentlemen who took an interest in this great undertaking. The plan most approved of, however, was the design of a bridge of suspension; and Mr. Telford the engineer, and captain Brown of the royal navy, are understood pretty nearly to have concurred in opinion as to the practicability of such a work. Mr. Telford has reported fully on the subject, and has estimated the expense of his design at from 63,000*l.* to 85,000*l.* according to different modes of execution. Though as yet little advancement has been made in carrying this enterprising design into execution, yet the novelty and magnitude of an arch of 1000 feet span, is a subject of so much interest, that we have thought it proper in this place to mention these circumstances.

We have already alluded to the great design of a chain bridge for the river Mersey. The first practical example, however, of this kind, was that over the Tees; and the next which we know of in this country, were those executed on the river Tweed, and its tributary streams of Gala and Etterick. Mr. Richard Lees, an extensive woollen-cloth manufacturer at Galashiels, whose works are situate on both sides of Gala-water, conceived the idea of forming a foot-bridge, of slender iron wires, for the conveniency of communicating readily with the different parts of his works. This gangway, or bridge, was erected in the month of November, 1816; its extent is 111 feet, and it cost about 40*l.* Though only of a very temporary, and even imperfect construction, yet being the first wire-bridge erected in Great Britain, it deserves our particular notice, as affording a useful practical example of the tenacity of iron so applied, and of its utility in many situations, and particularly in an inland country, such as the vale of the Tweed, where the carriage of bulky materials, of every description, is extremely expensive.

The wire-bridge followed the chain-bridge of Dryburgh; but we shall first describe the wire-bridge of Kingsmeadows, on the estate of sir John Hay, bart. This foot-bridge is thrown across the Tweed, a little below Peebles. It is 110 feet in length, and 4 feet in breadth, and is ornamented with a handsome lodge, or cottage. This work was contracted for, and executed by Messrs. Redpath and Brown, of Edinburgh, in the summer of 1817, and cost about 160*l*.

The only other wire-bridge, says Mr. Stevenson, which we shall notice, is that erected by the hon. captain Napier over the Etterick, at Thrilstone castle. A foot-bridge of rope-work had originally been thrown across here; but a wire-bridge is now erected, and measures about 135 feet span.

The wire-bridges of Galashiels, Kingsmeadows, and Thirlstane, above described, are suspended by diagonal braces. The same plan was also followed in the first erected bridge at Dryburgh abbey, where the suspending rods were also made to radiate from their points of suspension on either side, towards the centre of the roadway; for as yet the catenarian principle had not been introduced upon the Tweed. The bridge at Dryburgh is 260 feet in extent between the points of suspension, and is four feet in breadth. It was executed b Messrs. John and William Smith builders and architects near Melrose, at the expense of the earl Buchan, as proprietor of the ferry and has altogether cost his lordship about 720*l*. This bridge i constructed for foot passenger and led horses. It was originall begun on the 13th of April, 1817 and was opened to the public o the 1st day of August following having required little more tha three months for its erection.

It is observed by Mr. John Smith, one of the gentleme above alluded to, that when the original bridge of Dryburgh was finished, it had a gentle vibratory motion, which was sensibly felt in passing along it; the most material defect in its construction arose from the loose state of the radiating or diagonal chains, which in proportion to their lengths, formed segments of catenarian curves of different radii. The motions of these chains were found so subject to acceleration, that three or four persons, who were very improperly amusing themselves, by trying the extent of this motion, produced such an agitation in all its parts, that one of the longest of the radiating chains broke near the point of its suspension. On another occasion, in a very high wind, one of the horizontal chains, stretched under the beams of the roadway, gave way. But on the 15th of January, 1818, after this bridge had been finished about six months, a most violent gale of wind took place, when the vibrating motion of the bridge was so great, that the longest radiating chains were again broken, the platform blown down, and the bridge completely destroyed. Messrs. Smith happened unluckily to be from home at the time of the accident, but on examining a number of persons who saw it, they all concurred in stating, that the vertical motion of the roadway of the bridge before its fall, was as nearly as may be equal to its lateral motion, and was altogether concluded to be such as would have pitched or thrown a person walking along it into the river.

The sudden destruction of this bridge created a great sensation of regret throughout all parts of the country, and was considered an occurrence of so much importance in the erection of chain-bridges, that several of the gentlemen of Liverpool, interested in the proposed bridge at Runcorn, made a journey to Scotland, for the express purpose of inquiring into the circumstances of the misfortune. Messrs. Smith, the contractors, had engaged with the earl of Buchan, to erect this chain-bridge for somewhat less than 500*l.* and were bound to uphold it against all accidents only during the period of its erection, so that the loss fell wholly upon lord Buchan.

The utility of Dryburgh-bridge, when compared with a troublesome ferry, even on the short experience o six months, had given it such a decided preference to the boat, that his lordship, without hesitation, directed that it should be immediately restored: this was accordingly done after a better design, for the additional sum of about 220*l.*, and in less than three months it was again opened to the public. This bridge is now constructed upon the catenarian principle, the roadway being suspended by perpendicular rods of iron, from main or catenarian chains. The chief mechanical alterations upon the former plan consist in welding both eyes or ends of the links, instead of having one of them simply turned round, and fixed with a collar; the roadway has also been strengthened by a strongly trussed wooden rail, which also answers the purpose of a parapet, on each side of the bridge, the good effects of which were particularly exemplified, while the bridge was building. A high wind having occurred before the side-rails were erected, one end of the platform was lifted above the level of the roadway, and the undulating motion produced on this occasion is described as resembling a wave of the sea; an effect which pervaded the whole extent of the bridge, and went off with a jerking motion at the farther end. But after the side-rails were attached, this vertical motion was checked, and is now found to be greatly reduced. There was also added to the newly constructed bridge at Dryburgh, guys or mooring-chains, consisting of rods of iron fixed to stakes in the opposite banks of the river. These guys are attached to the beams of the roadway, and are said to have some effect in lessening the motion of the bridge in high winds, but it did not appear to Mr. Stevenson, when he examined the bridge in 1820, that these guys could act in any very sensible degree in this respect.

We have already stated generally, that the new bridge at Dryburgh is erected upon the catenarian principle. It may further be described as consisting of four main chains, which are suspended in pairs between the points of suspension, in a horizontal position relatively to each other; the lowest part of the curve of each pair of chains coming under the top of their corresponding side-rails The links of the catenarian chains are formed of rods of bar-iron, measuring $1\frac{3}{6}$ inches in diameter, constructed in lengths of about 10 feet each. The eyes at each end of these long rods are connected by short links of an oval form, measuring about 9 inches in length. The platform or roadway is suspended from the catenarian chains, by perpendicular rods of iron, of the strength of half an inch in diameter, which are attached at their upper ends to the short links above described, by a kind of cross head, while the under ends of these perpendicular rods, forming a screw-bolt, pass through the side-beams of the platform, and are attached to them with screw-nuts, resting upon corresponding washers, or plates of iron.

The points of suspension of this bridge rest upon upright posts, and are elevated 28 feet above the level of the roadway, on each side of the river. Each pair of chains are 12 feet apart at the approaches of the bridge, but they are made to converge towards its centre, where they are attached to the side-rails, and measure only 4½ feet apart, being the breadth of the roadway between the side-rails. By this converging form, the chains answer in some measure the purpose of guys to the roadway. It is, however, questionable, how far it is proper to give an oblique direction to the main chains; indeed we are rather inclined to think, that the main chains of bridges of suspension should be kept parallel to the direction of the strain.

The platform or roadway of Dryburgh-bridge is elevated about 18 feet above the surface of the river, when in its state of summer water. It consists of two beams of fir-timber, which run along the extent of the bridge, and are connected to each other with rails, or pieces of timber mortised into them. The side-rails, answering the purposes of hand-rails, are formed with diagonal braces and cross ties. The roadway is finished with a cleading of boards laid across the direction of the roadway, leaving openings of about five-fourths of an inch between each of the boards, to let off the moisture in wet weather. Under the platform, two chains made of circular rods, 1 inch in diameter, are stretched beneath the beams, and connected with the abutments of masonry on each side, as an additional security.

The back braces or landward chains employed for keeping the upright posts erect, and for counteracting the weight of the bridge, are made of rod-iron, 1 inch in diameter, which are sunk a considerable way into the ground, and pass through large flat stones, which are loaded with a mass of masonry, built in an arched form, and acting as ballast.

An occurrence took place, during the erection of Dryburgh-bridge, which deserves to be particularly noticed. It was observed, that the catenarian curve was not the same when the main chains were simply suspended with their own weight, as when they came to be loaded with the roadway. At the extremity of the chains on each side, and the centre of the bridge, the points of attachment remained stationary after the catenarian chains were loaded, but between the centre and either abutment, the roadway made two distinct curves, the versed sine of which measured about 7 inches. This defect was easily rectified, by shortening the suspending chains; but it serves to show the liability of the catenarian curve to alter, when loaded in the direction of the horizontal plane of the connecting roadway.

For the erection of a bridge at Dryburgh, on a ferry of comparatively small importance, the public are under no small obligations to the earl of Buchan: and the enterprise which marks the design and execution of it, confers honour on the architects.

The work to which we shall next direct the attention of he reader, is the Union-bridge across the river Tweed at Norham Ford, about five miles from Berwick. The work here was begun in the month of August, 1819, and the bridge was opened on the 26th of July, 1820, having required only a period of about twelve months for its erection; while a stone-bridge must have been the work of about three years. This work was designed and executed by captain Samuel Brown of the royal navy, who has so successfully introduced the use of the chain-cable into the navy and mercantile marine.

The roadway of this bold design is made of timber, on which ron cart-tracks are laid for carriage wheels. It is 18 feet in width, and is no less than 361 feet in length. The main beams or joisting measure 15 inches in depth, and 7 inches in thickness. The timber cleading or planks are 12 inches in breadth, and 3 nches in thickness. This great platform is suspended at the height of 27 feet above the surface of the summer water of the river. It is also made to rise about 2 feet in the centre, and is inished on each side with a cornice of 15 inches in depth, which adds to its ornament, and gives t an additional appearance of trength.

The roadway is suspended from the catenarian or main chains by circular rods of iron, which measure 1 inch in diameter. These perpendicular rods are wedged into caps or pieces of cast-iron, called saddles, which are placed at the distance of 5 feet apart, and made to rest upon the shackles or joints of the catenarian chains. The attachment of the lower ends of these rods to the beams of the platform which they pass through, is by their embracing a bar of iron which runs along the whole extent of the bridge under the beams of the roadway, on each side. These bars measure 3 inches in depth, and they are connected with the suspending rods by a spear or bolt, which, in a very simple manner, completes the connexion of the roadway with the perpendicular suspending rods, and catenarian chains.

The catenarian chains of this bridge are twelve in number, ranged in pairs; the one pair being placed over the other, between the points of suspension on each side of the bridge. These chains, and indeed the whole of the iron-work, is made of the very best Welsh iron. The chains are worked into a circular form, and measure about 2 inches in diameter. The links, as they may be termed, consist of rods of 15 feet in length, and have bolt-holes, which are strongly welded, and neatly finished, at each end. These links or rods are connected together by strong shackles, and a bolt is passed through them, which is of an oval form, measuring 2¼ by 2¼ inches. At each joint of the three ties of the catenarian chains respectively, one of the saddlepieces of cast-iron, formerly alluded to, are introduced. The first saddlepiece, with its suspended rod, for example, on either side of the bridge, may be conceived as resting on the upper pair of chains, the next saddlepiece in the longitudinal direction of the roadway, rests upon the middle pair of chains, and the third upon the lower pair, and so on alternately, throughout the whole extent of the bridge. By this means all the chains bear an equal strain, and the joints are arranged in so precise and orderly a manner, that a saddlepiece and perpendicular suspending rod occurs at every 5 feet, so that the distance between each pair of suspending-rods forms a space of 5 feet. By this beautiful and simple arrangement, the suspending-rods are made to rest upon the joints of the catenarian chains, so that the links or rods of which they are composed, are kept free of distortion, when loaded with the weight of the suspended roadway.

The spaces of 5 feet between the suspending rods above alluded to, are formed into meshes of 6 inches square, to the height of 5 feet on each side of the bridge, and answer the purposes of a parapet wall for the safety of passengers.

Though the timber roadway is only about 361 feet in length, yet the chord line of the main chains measures no less than 432 feet between the points of suspension, with which they make an angle of about twelve, and forming the catenarian curve-drop, at the rate of one perpendicular to about 7 feet in the length of chain, the versed sine of the middle pair of chains being about 26 feet. The twelve main chains, with their apparatus, weigh about five tons each, and the weight of the whole bridge, between the points of suspension, has been estimated at one hundred tons.

On the Scotch side of the river, the catenarian chains pass over a pillar of aisler masonry, which measures 60 feet in height, is about 36 feet in its medium width, and 17½ feet in thickness. The sides of the lower 10 feet of the walls of this pillar are square, but at this height the walls begin to slope at the rate of one perpendicular to twelve horizontal. The archway in the masonry of this pillar, which forms the immediate approach to the roadway, measures 12 feet in width, and 17 feet in height. Each pair of main chains being suspended horizontally, pass through corresponding apertures in the masonry, at the distance of about 2 feet from one another, and go over rollers connected with the building. The links of the main chains at these points are made as short as the strength or thickness of the iron will permit of their being welded, in order that they may pass over the rollers, without distorting or unduly straining the iron. After going through the masonry of the pillar, the chains are continued in a sloping direction to the ground. Here they are sunk to the depth of 24 feet, where they pass through great ballast plates of cast-iron, into which they are stopped by a strong iron spear or bolt, of an oval form, measuring 3 inches by 3½ inches in thickness. The cast-iron ballast plates measure 6 feet in length, 5 feet in breadth, and 5 inches in thickness in the central parts; but towards the edge, they diminish in thickness to 2½ inches. The ends of the chains thus fixed, are loaded with mound-stones and earthy matters, to the level of the roadway of the bridge.

On the English side of the Tweed, the pillar or tower of masonry forming the abutment or point of suspension, is built upon a bench or foundation, excavated in the face of a precipitous sandstone rock, and is only about 20 feet in height, but its other dimensions correspond with the upper part of the masonry on the Scotch side. The chains on the English side are made to rest upon plates of cast-iron, included in the masonry, instead of rollers, as on the opposite side. Here the ballast-plates are of the same dimensions as those already described, but instead of being sunk into the ground, as on the Scotch side, their position is rather above the foundation of the pillar, where they are set nearly perpendicular, but are placed so as to correspond with the direction of the strain or weight of the bridge. For the greater security of the position of these ballast-plates on the English side, they are connected with a horizontal arch of masonry, which is dovetailed into the rock. This part of the work, however, was not in a finished state when Mr. Stevenson saw it, at the ceremony of opening the bridge on the 26th of July, 1820. Upon this side, the approach to the roadway forms a curve in front of the pillar, instead of passing through an archway, as on the Scotch side.

The general effect of the Union-bridge, which we have now endeavoured to describe, is interesting and curious; and such is the extent, and its light and elegant appearance, that it has not inaptly been compared to an inverted rainbow. Those who visit this undertaking, as affording much novelty to the scenery of this part of the banks of the Tweed, will not be disappointed in their expectations; while in a national point of view, as a great improvement, it deserves the most particular consideration of the country at large. It is also of much interest to the professional engineer, especially as being the first bridge of suspension erected in Great Britain, calculated for the passage of loaded carriages. Nor ought the enterprising efforts of Mr. Molle, and the gentlemen of the adjoining shires of Berwick and Northumberland, to be overlooked in the prosecuting of this design, as affording a great practical lesson for the application of bridges of this construction to various parts of the United Kingdom, where stone or even cast-iron would be found impracticable, both on account of the extent of the situation, and the unavoidable expense of the works.

The fastidious, upon examining this work, may perhaps find some parts of the general design capable of improvement, and when a second work of a similar or a greater extent comes to be executed, there is little doubt that experience will, in the usual course of things, lead to alterations for the better. We, however, think that the design and execution of the Union-bridge does the highest credit to captain Brown, in the construction of bridges on the catenarian principle.

Although Mr. Stevenson has stated above that the Union-bridge was the first bridge of suspension erected in Great Britain, yet the first proposal for a bridge of this kind was that by Mr. Telford, in 1810, for passing the straits of Menai, which separate the island of Anglesea from Caernarvonshire

These straits have long formed a troublesome obstruction upon the great road from London to Dublin, by Holyhead; and it has hitherto been customary for travellers to cross in a ferry boat at Bangor. The inconvenience and risk attending this mode, has led to speculations of improvement for half a century past; but none of the plans that were proposed to government previously to the month of May, 1810, were considered of sufficient practical utility to warrant their being carried into execution.

From a report of a committee of the house of commons in June, 1811, it appears, that in May, 1810, Mr. Telford was instructed by the lords of the treasury, to survey and report upon the best method of improving the lines of communication between Holyhead and Shrewsbury, and also between Holyhead and Chester; and to consider and give plans for passing the Menai. In the aforesaid report (of 1811) we have his plans and estimate. His explanations we shall give in his own words.

"The duty assigned me being to consider and report respecting a bridge across the Menai, I shall confine myself to this object. Admitting the importance of the communication to justify acting on a large scale, I not only consider the constructing a bridge practicable, but that two situations are remarkably favourable. It is scarcely necessary to observe, that one of these situations is at the Swilley rocks, and the other at Ynys-y-Moch. These two being so evidently the best, the only question that can arise is, to which of them preference ought to be given.

"From the appendix to the second report to the Holyhead roads and harbour, it appears, that a considerable number of small coasting-vessels, viz. from sixteen to one hundred tons, navigate the Menai, and that there have been a few from one hundred to one hundred and fifty tons. By statements from the principal shipbuilders in the river, made in the year 1800, to the committee for improving the port of London, it also appears, that vessels of one hundred and fifty tons, when they have all on end, are only 88 feet in height above the water-line; and further, that even ships of three hundred tons, with their topgallant-masts struck, are nearly the same height; these, in the Menai, are extreme cases, and, if provided for, ought, as to navigation, to satisfy every reasonable person; it may, indeed, rather be a question, whether the height should not be limited to vessels under one hundred tons, by which the expense of a bridge would be considerably diminished.

"In the plans I have formed, provision is made for admitting vessels of one hundred and fifty tons to pass with all on end; that is, in one design preserving 90 feet, and in the other 100 feet between the line of high water and the lower side of the soffit of the arch. The first design is adapted for passing across the three rocks, named the Swilley, Bendlass, and Ynys-y-well-dog; for which, their shape and position are singularly suitable. To embrace the situation most perfectly, I have divided the space into three openings of 260 feet, and two of 100 feet each; making piers each 30 feet in thickness. Over the three large openings, the arches are made of cast-iron; over the smaller spaces, in order to add weight and stability to the piers, semicircular arches of stone are introduced; but over these, as well as the larger openings, the spandrels, roadway, and railing, are constructed of cast-iron. In this way the navigation is not impeded, because the piers standing near the outer edges, are guards for preventing the vessels striking upon the rocks; while the whole structure presents very little obstruction to the wind. From the extremity of the abutments, after building rubble walls above the level of the tideway, I propose carrying embankments until the roadway reaches the natural ground. The annexed drawing will sufficiently explain the nature of the design. I propose the bridge to be 32 feet in breadth; and, from minute calculations, made from detailed drawings, I find the expense of executing the whole, in a perfect manner, amounts to 158,654*l*.

"The other design is for the narrower strait called Ynys-y-Moch. Here the situation is particularly favourable for constructing a bridge of one arch; and making that 500 feet span, leaves the navigation as free as at present. In this I have made the height 100 feet in the clear at high water spring tides; and I propose this bridge to be 40 feet in breadth. Estimating from drawings, as already described, I find the expense to be 127,331*l*., or 31,323*l*. less than the former. From leaving the whole channel unimpeded, it is certainly the most perfect scheme of passing the Menai; and it would, in my opinion, be attended with the least inconvenience and risk in the execution.

"In order to render this evident, I have made a drawing, (see Plate C,) to show in what manner the centering or frame, for an arch of this magnitude, may be constructed. Hitherto, the centering has been made by placing supports and working from below; but in the case of the Menai, from the nature of the bottom of the channel, the depth at low water, and the great rise and rapidity of the tides, this would be very difficult, if not impracticable. I therefore propose changing the mode, and working entirely from above; that is to say, instead of supporting, I mean to suspend the centering. By inspecting the drawing, the general principle of this will be readily conceived.

"I propose, in the first place, to build the masonry of the abutments as far as the lines AB, CD, and in the particular manner shown in the section. Having carried up the masonry to the level of the roadway, I propose upon the top of the abutments to construct as many frames as there are to be ribs in the centre; and of at least an equal breadth with the top of each rib. These frames to be about 50 feet high above the top of the masonry; and to be rendered perfectly firm and secure. That this can be done is so evident, that I avoid entering into details respecting the mode. These frames are for the purpose of receiving strong blocks, or rollers and chains, and to be acted upon by windlasses or other powers.

"I next proceed to construct the centre itself: it is proposed to be made of deal bulk, and to consist of four separate ribs; each rib being a continuation of timber frames, 5 feet in width at the top and bottom, varying in depth from 25 feet near the abutments to 7 feet 6 inches at the middle or crown. Next to the face of the abutments, one set of frames, about 50 feet in length, can, by means of temporary scaffolding, and iron chain bars from the before-mentioned frames, be readily constructed, and fixed upon the offsets of the abutments, and to horizontal iron ties laid in the masonry for this purpose. A set of these frames, (four in number,) having been fixed against the face of each abutment, they are to be secured together by cross and diagonal braces; and there being only spaces of 6 feet 8 inches left between the ribs, (of which these frames are the commencement,) they are to be covered with planking, and the whole converted into a platform 50 feet by 40. By the nature of the framing, and being secured by horizontal and suspending bars, I presume every person accustomed to practical operations will admit that these platforms may be rendered perfectly firm and secure.

"The second portion of the centre frames, having been previously prepared and fitted in the carpenter's yard, are brought, in separate pieces, through passages purposely left in the masonry, to the before-mentioned platforms. They are here put together, and each frame raised by the suspending bars and other means, so that the end which is to be joined to the frame already fixed, shall rest upon a small moveable carriage. It is then to be pushed forward, perhaps upon an iron rail-road, until the strong iron forks, which are fixed on its edge, shall fall upon a round iron bar, which forms the outer edge of the first, or abutment frames. When this has been done, strong iron bolts are put through eyes in the forks, and the aforesaid second portion of the frame-work is suffered to descend to its intended position, by means of the suspending chain bars, until it closes with the end of the previously fixed frame, like a rule joint. Admitting the first frames were firmly fixed, and that the hinge part of this joint is sufficiently strong, and the joint itself 20 feet deep, I conceive, that even without the aid of the suspending bars, that this second portion of the centering would be supported; but we will for a moment suppose that it is to be wholly suspended. It is known, by experiment, that a bar of good malleable iron, 1 inch square, will suspend eighty thousand pounds, and that the powers of suspension are as the sections; consequently, a bar 1½ inch square, will suspend one hundred and eighty thousand pounds; but the whole weight of this portion of the rib, including the weight of the suspending bar, is only about thirty thousand pounds, or one-sixth of the weight that might safely be suspended; and as I propose two suspending chain bars to each portion of rib, if they had the whole to support, they would only be exerting about one-twelfth of their power; and considering the proportion of the weight which rests upon the abutments, they are equal also to support all the iron-work of the bridge, and be still far within their power.

"Having thus provided, for the second portion of the centering, a degree of security far beyond what can be required, similar operations are carried on from each abutment until the parts are joined in the middle, and form a complete centering; and being then braced together, and covered with planking where necessary, the whole becomes one general platform or wooden bridge, to receive the iron-work.

"It is, I presume, needless to observe, that upon such a centering or platform, the iron-work, which, it is understood, has been previously fitted, can be put together with the utmost correctness and facility; the communication from the shores to the centering will be through the before-mentioned passages left in the masonry."

"The form of the iron-work of the main ribs will be seen, by the Drawings, to compose a system of triangles, preserving the principal points of bearing in the direction of the radius. It is proposed in the breadth of the bridge, (i. e. forty feet,) to have nine ribs, each cast in twenty-three pieces, and these connected by a cross-grated plate, nearly in the same manner as in the great aqueduct of Pontcysylte over the valley of the Dee, near Llangollen; the fixation of the several ribs in a vertical plane appearing (after the abutments) to be the most important object in iron bridges, I propose to accomplish this by covering the several parts, as they are progressively fixed, with grated or reticulated and flanched plates ' across the top of the ribs. This ' would keep the tops of the ribs ' immoveable, and convert the whole ' breadth of the bridge into one ' frame; besides thus securing the ' top, I propose also having cross ' braces near the bottom of the ' ribs.

"The main ribs being thus fixed, ' covered, and connected together, ' the great feature of the bridge is ' completed; and as, from the ' accurate experiments made and ' communicated to me by my ' friend, the late William Rey-' nolds, of Coalbrook Dale, it ' requires 448,000 lbs. to crush ' a cube of ¼ inch of cast iron of ' the quality called gun-metal, it ' is clear, that while the ribs are ' kept in their true position, the ' strength provided is more than ' ample.

"When advanced thus far, I ' propose, (though not to remove,) " yet to ease the timber centering, " by having the feet of the center-" ing ribs, (which are supported by " offsets in the masonry of the " front abutment,) placed upon " proper wedges; the rest of the " centering to be eased at the same " time by means of the chain-bars. " Thus, the hitherto dangerous " operation of striking the center-" ing, will be rendered gradual, " and perfectly safe: insomuch, " that this new mode of *suspending* " the centering instead of *support-" ing* it from below, may, perhaps, " hereafter be adopted as an im-" provement in constructing iron " bridges, even in places not cir-" cumstanced as are the Menai " Straits. Although the span of " the arch is unusually great, yet " by using iron as a material, the " weight upon the centre, when " compared with large stone arches, " is very small; taking the mere " arch stones of the centre arch " of Blackfriars' Bridge at 156 × " 43 × 5 equal to 33,540 cubic " feet of stone, it amounts to 2,236 " tons; whereas the whole of the " iron work in the main ribs, cross " plates and ties, and grated covering " plates, that is to say, all that is " lying on the centering at the " time it is to be eased, weighs " only 1,791 tons; it is true, that " from the flatness of the iron arch, " if left unguarded, a great propor-" tion of this weight would rest " upon the centering; but this is " counterbalanced by the operation " of the iron ties in the abutments, " and wholly commanded by the " suspending chain-bars.

"When the main iron ribs have " been completed, the next step is to ' proceed with the iron supporters ' of the roadway; and these, in-" stead of being constructed in the " form of circles, or that of per-" pendicular pillars, as hitherto, "are here a series of triangles, "thus including the true line of "bearing. These triangles are, "of course, preserved in a vertical "plane by cross-ties and braces: "iron bearers are supported by "these triangles, and upon the "bearers are laid the covering "plates under the road-way, which, "instead of being solid, are (in "order to lessen the weight) pro-"posed to be reticulated."

Mr. Telford's idea of suspending the centering led to the proposal of a suspension bridge, which was approved of by a select committee of the House of Commons (see the Third Report from the Select Committee on the Road from London to Holyhead, &c. 29 Ap. 1819.) On a report being made to parliament, the necessary funds were granted, and the work was soon after commenced at Ynys y Moch, on the Anglesea shore. The bridge consists of one opening of five hundred and sixty feet between the points of suspension, and one hundred feet in height between the high-water line and the lower side of the road-way; and the road-way being horizontal, this height is uninterrupted for the whole five hundred feet between the piers, except where the natural rock (which forms the western abutment) now interposes. But in addition to these five hundred feet, there are four arches on the western side, and three on the eastern of the main opening, each fifty feet span, composed of stone, making in all eight hundred and fifty feet of opening. The road-way will consist of two carriage-ways, each twelve feet in breadth, with a foot path of four feet between them, so that the platform is about thirty feet in breadth: the whole suspended from four lines of strong cables of malleable iron, by perpendicular iron rods placed five feet apart, these rods supporting the road-way framing. The suspending power was calculated at two thousand and sixteen tons, and the weight to be suspended, exclusive of the cables, at three hundred and forty-two tons, leaving a disposable power of one thousand six hundred and seventy-four tons. The four sides of the road-ways are made of framed iron work, firmly bound together, for seven feet in height, with a similar work for five feet below the cables: the weight of the whole bridge, between the points of suspension, was estimated at four hundred and eighty-nine tons. It was calculated that the contraction and expansion of the iron cables might occasion a rise or fall to the extent of four or five inches; but the variations of the temperature of the atmosphere would not derange the bridge. The abutments consist of stone work, and each of the two piers is sixty feet by forty-two and a half wide, at high-water mark, having a foundation of rock. Those piers (connected with the whole of the remainder of the masonry) form a mass constructed with blocks of hard limestone, of much greater weight than is necessary for supporting a bridge of this kind. Two main pillars, or piers, also of the most substantial masonry, were constructed for the purpose of raising the cables from which the bridge is suspended. As the cables are carried over the top of these pyramids, so as to form nearly similar angles on each side, the pressure is almost perpendicular.

Mr. Telford proposed to have four lines of suspension in the breadth of the bridge, and in each line four cables, making in the whole sixteen; these cables pass over rollers fixed on the summit of the pyramids, and are fastened at the extremities to an iron frame, lying horizontally over the top of the small arches, and under a mass of masonry. From these cables the road-way is suspended by vertical iron rods, connected at their lower extremities with wrought iron bars, both transversely and longitudinally; thus forming a frame on which to lay timber for the road-way. The distance of five feet is kept between the rods, in order that the suspending power may be equally distributed throughout the whole length of the bridge. The suspending rods pass between the cables, and depend upon each two of them, so that the general strength of the bridge would not materially be affected by taking one away.

The cables and the flooring, as well as the suspending rods, are constructed and united in such a manner, that each of the parts may be taken out and replaced separately; so that there can be no difficulty in repairing any part of the bridge whenever required.

Mr. Telford, in his evidence before the Select Committee, says, "The distance between the points of suspension being five hundred and sixty feet, and the versed sine thirty-seven feet, or about one-fifteenth of the chord line; by calculation, I find that the weight to be suspended is three hundred and forty-two tons; and by numerous experiments made to ascertain the strength of malleable iron, it appears, that with a chord line of five hundred and sixty feet, and a versed sine of thirty-seven, a good bar of iron, one inch square, will (besides its own weight) carry ten tons and a half, and about one half that weight, before it begins to stretch (permanently.) The Menai bridge contains a section of one hundred and ninety-two square inches, which, at five and a quarter tons to each square inch, will support one thousand and eight tons, being a surplus of six hundred and sixty-six tons above the real weight of the bridge; and there would be required a further weight of one thousand and eight tons to break down the bridge, which may be deemed more than sufficient against any probable trial to which the bridge can be exposed. The cables passing over the stone piers constructed of the most solid masonry, will then pass down to the cast-iron frame before described, thereby embracing the whole mass of masonry and spandrils, making in all about twelve thousand tons at each end of the bridge, exclusive of the great pyramids. The weight of the bridge between the points of suspension, including cables, being only four hundred and eighty-nine tons, there is not much reason to expect undulation, from any weight which will be laid on any particular part; but to guard against any effect of that sort, four sides of the road-ways, of framed iron-work firmly bound together for seven feet in height, and similar work for five feet in depth below the cables, which, when they meet together in the centre of the bridge, will constitute a frame-work twelve feet deep, with a bridge of thirty feet in breadth, and five hundred and thirty-two in length, there is not much to be apprehended from side vibration; but in order to provide against this possibility, two horizontal cables crossing the bridge diagonally, each of which laying hold of the middle of its length, and passing round a cast-iron frame projecting from the opposite sides of the great pyramids.

and from thence carried to the masonry of the abutments; thus creating a diagonal stay upon seventy feet in breadth."

The weight of the bridge is four hundred and eighty-nine tons; upon which, if three hundred tons are placed, they make seven hundred and eighty-nine tons:. the pull of this weight at the abutments, upon a curvature of 1-15th, is found by experiment, over a pulley with a perpendicular weight, to be equal to about two and half times the weight of the other side, or one thousand nine hundred and seventy-two tons; to counteract this, the cables are continued at nearly the same angles as those of the bridge, to the cast iron frame, which embraces about twelve thousand tons of masonry.

The cables are formed of a number of straight half-inch bars, connected at different lengths. On the square sides of these bars are laid segments of circles, of a proper size for making the cables of a cylindrical form; the bars, as well as segments, joined longitudinally to the whole of the required length, and secured by bucklings every five feet, and then enveloped in flannel, well saturated with a composition of rosin and bees' wax, to preserve them from the weather, and the whole encircled with wire. The weight of each separate cable, from the points of suspension, is nine tons and three quarters, or one hundred and seventeen pounds per yard. The weight of a drove of oxen is calculated at about three hundred tons, supposing them to amount to two hundred head, all closely huddled together, and the estimated weight necessary to tear the cables asunder is upwards of two thousand tons, which is about four times the weight of the entire bridge. The passing of a mail coach over the bridge was not expected to produce any undulation, or sensible perpendicular vibration; nor was any lateral vibration apprehended from the most violent gale of wind, by reason of the proportion that the breadth of the bridge bears as a frame to its extreme length.

The committee of the House of Commons appointed to inquire into the state of the Chester and Holyhead road, found that great delays occurred in the arrival of the mails from Chester at Holyhead, which were owing partly to the bad state of the roads, but in a still greater measure to the ferry at Conway, which was attended with serious inconvenience, much delay, occasional danger, and even actual loss of lives. Two plans were proposed by Mr. Rennie, who was of opinon, that no situation was so well adapted for the purposes of a bridge as that opposite the castle; but which he considered would be an expensive undertaking; the channel being wide, and great part of it of a loose moving sand. A grant of £40,000 was obtained from parliament towards defraying the expense of erecting a suspension bridge.

According to one of Mr. Rennie's designs, he proposed to build a bridge opposite to the east end of the castle, having its approach through the middle of the castle, which could easily be effected without injuring its beauty; and at the west end of the castle a bank of earth, to make the approach, either to the market-place, or lower down, easy and convenient, for the town itself, as well as the public. At the east end of the castle he proposed to raise two towers, corresponding with those of the castle, to serve as an abutment; and four towers on the island, connected together by rubble walls; between these he proposed a cast-iron arch of three hundred and fifty feet span, and one hundred feet from the water at an ordinary spring-tide, to its crown, which was more than sufficient for the navigation of any vessel trading in that river. From the abutment on the island, a causeway of rubble-stone, fifty feet broad at the top, and sloping about three to one on each side: this causeway was to be sunk in the sand four feet, and its top higher than low-water mark, the stones well rammed together, and guarded by sills with sheeting piles driven twenty feet into the sand, and connected by cross sills. This causeway was to extend as far as the deep water, about two hundred and thirty yards, and on it piers and twelve arches, and between the piers inverted arches, to equalize the weight of the structure; from the end of the causeway an embankment of earth to extend to the shore; the breadth of the road was to be thirty-two feet within the parapet. By this plan, the strength of the tide would, in some respect, be confined to the Conway shore, but allowed to pass through the arching on the opposite side of the island, considerably below high water, consequently not likely to check the tide, or be injurious to the town of Conway. Another design of Mr. Rennie's was, to dispense with any stone arches, and continue the embankment to the island.

This last plan, in many respects, corresponds with the one proposed, and carried into execution, by Mr. Telford, which consists of one opening or suspension bridge, from the castle to the island, comprising a span of three hundred and fifty feet. The communication between the island and eastern shore is by an embankment of earth, cased with a thick coating of stones, which counteracts the operation of the tide upon the eastern embankment. The road-way of the bridge is suspended from cables, similar to the Menai, carried over towers at the points of suspension. Here, however, there is only one road-way, with foot-paths on each side; in other respects, the construction of this bridge, in minute particulars, so closely corresponds with the one over the Menai, that a lengthened detail would be tedious and uninteresting. The pillars supporting the cables are about twenty-four feet high from the road-way, and the distance from high-water mark to the road-way is about eighteen feet. The depth of water under the bridge at high-water is generally from twenty-three to twenty-six feet, and at low water from twelve to fifteen feet.

A bridge was proposed to be erected over the estuary of the Mersey at Runcorn Gap, about twenty miles from Liverpool, at the suggestion of some highly patriotic gentleman of Liverpool. The specification for this work provided, that the span of the bridge should measure, at least, one thousand feet, and that its height above the surface of the water should not be less than sixty feet, so as to admit of the free navigation of this great commercial river. A variety of designs for this bridge were procured by a select committee of the gentlemen who took an interest in this great undertaking. The plan most approved of, however, was the design of a bridge of suspension; and Mr. Telford, the engineer, and Captain Brown, of the royal navy, are understood pretty nearly to have concurred in opinion as to the practicability of such a work. Mr. Telford reported fully on the subject, and estimated the expense of his design at from £63,000 to £85,000, according to the different modes of execution.

An act of parliament was obtained in 1824, incorporating certain individuals who had agreed to subscribe £80,000 for defraying the expense of building a suspension bridge over the Thames, at Hammersmith, which was opened for the use of the public on the twenty-third of August, 1827. This bridge consists of two suspension piers or towers, built in the river, having an opening of four hundred feet between them. On the opposite shores are two strong abutments, over which, a nearly level roadway passes through archways in the suspension towers. It is suspended by four lines of strong chains, hanging in curves from the abutments over the towers, and down between them; the roadway being suspended from them by vertical rods.

The total length of the bridge, consisting of

	ft.	in.
The central opening	400	3
The two suspension towers (22 feet each)	44	0
The distance between the towers and abutment on the Middlesex side	142	11
The distance between the towers and abutment on the Surrey side ..	145	6
The two abutments (45 feet each)	90	0
Is	822	8

The width of the water-way is

Middle opening	400	3
Surrey side............	145	6
Middlesex side	142	11
Total width	688	8

The suspension towers are

	ft.	in.
In height above the level of the roadway......	48	0
Width	22	0
Breadth	42	0
The road for carriages is in width	20	0
Through the towers of the archways it is in width	14	0
The two footpaths are each	4	0
The height of the road above high water is ..	16	0
The span supported by the central parts of the chains is	400	3
The depression of the middle of the curve below the level of the points of suspension .	29	6

The four lines of chains are each composed of two sets of bars, one set immediately over the other, and about one foot higher. The principal chains, forming the sides of the roadway, are composed of six bars or links, eight feet nine inches three-quarters from centre to centre of the bolt holes, five inches deep, and one inch thick, are placed side by side, with intermediate connecting plates of one inch thick, and eight and a half deep, making together seven plates to connect the six bars or links.

In America, the application of suspension bridges has of late years been very frequent, but they are not of such great dimensions between the points of suspension as in great Britain. That over the Merrimack, at Newbury Port, which was built by Mr. Templeman, at an expense of twenty-five thousand dollars, is a curve, whose chord measures two hundred and forty-four feet. There are two other chain bridges, of one inch and a quarter iron bars, both measuring one hundred and thirty-five feet between their points of suspension. The one, called Cumerland bridge, is at Maryland, nd the other at Federal city: oth are described by Pope in his Bridge Architecture," published t New York in 1811. The chain ridge over the river Brandywine, t Wilmington, is constructed of on bars, measuring one inch and iree-eighths, and its chord one undred and forty-five feet. That t Brownsville, in Fayette county, ver the Monongahela, is of inch-nd-quarter bars, measuring one undred and twenty feet between ie points of suspension: and nother in its vicinity, of the same iickness of metal, forms an in-erted suspended arch, with a iord of one hundred and twelve eet between the rebutments. That ver the Schuylkill at Philadelphia, onsists of chains formed of iron ars, one inch and a half square, eing a catenary of one hundred nd forty feet between the points f suspension.

The readiest, and probably the iost ancient, material for the con-truction of bridges, is timber. 'alladio has given several designs f his own invention for wooden ridges, some of which we have iven in our plates to the present rticle. One, which he built over ie Cismone, at the foot of the lps, between Trent and Bassano Italy, is simple and ingenious, ie whole being suspended by the raming which forms the sides. ts form is the segment of a circle f two hundred and twenty-six eet in diameter, its chord one hun-red and thirteen feet seven inches, s versed sine fifteen feet three nches, and the height of the tim-er framing of its arch, at the ertex, ten feet four inches.

Germany is, however, the school or wooden bridges. Of these, the iost celebrated was that over the Rhine at Schauffhausen, which was destroyed by the French in April, 1799. It was designed and executed by Ulric Grubenman, a common carpenter of Tueffen, who produced a model for it to the committee entrusted with the conduct of the works, and completed it in 1758. Its total length was three hundred and sixty-four feet, and its breadth eighteen feet, and it was supported only by the abutments on the banks of the river. A figure of it is given in our plates to the present article. John, the brother of Ulric, about the same time, constructed a timber bridge of the same sort at Kuiehenaw, two hundred and forty feet in length; and they conjointly erected one some years afterwards near Baden, over the river Limmat, two hundred feet in length. They also erected another bold and well-constructed bridge at Writtenghen, upon the same principles. Its curve was the segment of a circle of three hundred and forty-eight feet in diameter, whose chord measured one hundred and ninety-eight feet, its versed sine thirty-one feet, and the height of the timber frame-work of the arch, at the vertex, seven feet five inches.

Several timber bridges were erected during the years 1807, 1808, and 1809, in Germany, by the ingenious and skilful Wiebeking. The widest span is that over the Regnitz, at Bamberg, which is two hundred and eight feet. His other principal bridges are that over the Wertach at Elsingen, that over the Vils at Vilshoven, over the Danube at Neuberg, two over the Isar at Freysinghen in Bavaria, over the Inn at Oettingen, over the Alz at Altenmarkt, over the Inn at Rosen, over the Lech, near Augsburg, over the Inn at Muhldorff, and over the Rott.

There have been many capital

timber bridges constructed in America. The Trenton bridge over the Delaware, built by Burr in 1804, is the segment of a circle of three hundred and forty-five feet in diameter, its chord measuring two hundred feet, its versed sine thirty-two feet, and the height of the timber framing of the arch at its vertex only two feet eight inches. That called the Colossus, over the Schuylkill in Philadelphia, is of the extraordinary span of three hundred and forty feet, and is the segment of a circle of one thousand four hundred and sixty-five feet in diameter, its versed sine measuring only twenty feet, and the height of the wooden framing of the arch at the vertex only seven feet. It was finished in 1813, by Wernwag. Several fine timber bridges have been erected by the ingenious American mechanic, Palmer, one over the Merrimack at Deer's Island, near Newbury Port, another over the Schuylkill at Philadelphia, and another over the Piscataqua, near Portsmouth, whose arch is put together with wooden keys, similar to those proposed by Price in his Treatise on Carpentry.

Practice. It is an observation of universal truth, that the openings of a bridge should be as few in number, and as wide in dimensions, as the height and situation will allow. It is the truth of this observation which has given rise to the projection of iron arched and suspension bridges. The best position for a bridge is at right angles to the stream, because the piers then present the smallest obstacle to the stream, and free passage is given to the water. Some people have recommended that bridges should be built oblique to the stream, and there have been instances of bridges built in such a position, but this position has generally been regulated by the particular circumstances of the place. The oldest way of preparing for the foundations of the piers of bridges appears to have been by turning the river into a new channel during the time of building. The next method adopted, appears to have been by coffer-dams, and by caissons, which latter method was successfully practised by Labelye at Westminster bridge, and by Milne at Blackfriars. See *Caisson*. The coffer-dam was used by Semple in laying the foundation of the piers of the Essex bridge, Dublin. As the narrative of the proceedings in the erection of this bridge are an excellent illustration of the practice of bridge-building, we extract the following account from the Encyclopedia Metropolitana, abridged from Mr. Semple's own description

"Semple, who built this handsome and substantial bridge over the Liffey, published a valuable and ingenious journal of his proceedings, difficulties, and confessions of his want of knowledge. But he succeeded in building one of the handsomest structures of the kind in Europe. It is in design a mere copy of Labelye's Westminster bridge. His success, after many appaling difficulties, was so great, that a knowledge of them will render similar operations a comparatively easy task. Semple was, however, a man of genius; and although he copied his elevation from Labelye, the construction of Essex bridge by coffer-dams, and a continued foundation, while that of Westminster, then just finished, was by caissons, proves him to have possessed great practical skill, and a mind fertile in resources, and a steady patience, most requisite to the architectural engineer. He took Alberti for his master, and followed his observation, that the best architects used to make a continued foundation of the whole length of the bridge, and not only under each pier; and this they did, not by shutting out the whole river at once by one single enclosure, but by first making one part, then another, and so joining the whole together by degrees; for it would be impossible to withstand and repulse the whole force of the water at once.

"On his return to Dublin (from London) he immediately proceeded to sum up, and reconsider all the knowledge which he had acquired concerning coffer-dams; the result of which was, that he found himself exactly at the point whence he had started. His inventive talents had projected a coffer-dam of such power and originality as puzzled the precedent mongers, and alarmed himself. Fortunately, at this juncture he obtained, through a friend in Paris, Belidors' fourth volume of *Hydraulic Architecture*, then just published, together with the other three volumes of that useful work, and a prospective view of the men at work in a coffer-dam of the great bridge then building at Orleans. The language he was a stranger to, but his motto being, 'the greater the difficulty, the greater the conquest," he turned over the plates, and received confidence in his plans from his quick perception of Belidor's construction of coffer-dams. He then immediately commenced his undertaking with vigour, and completed it with success. The scientific men of England were at this time divided about the question of caissons and coffer-dams. Labelye, who was building the new bridge at Westminster, headed the caisson faction, and aserted, that it was impossible to make a dam sufficiently stanch for the work. Semple, however, persevered in his enclosure of battredeau, having acquired great confidence in his scheme, and firmly believing that of all methods that had been invented, none were so secure, or so pleasant to execute, as that of building and laying foundations of bridges on terra firma. He, therefore, began in January, 1753, to stop up and demolish the old bridge, and to remove the equestrian statue of George the First, which had been erected in 1722; previously making an estimate of the expense, which he had calculated at twenty thousand pounds, and promised that he would not exceed twenty thousand five hundred pounds. In February of the same year he drove the first pile of his much discussed coffer-dam, and having passed the rubicon of caissons and battredeaux, he continued his operations, and finished his dam. He was proceeding very successfully, till, on the 28th of April, a violent land-flood came down from the mountain streams that run into the Liffey, which drove the men from their work; and while he was on the top of the dam, he felt the whole rise, and it was immediately torn up, and scattered all over the river. Not to be disconcerted, he recommenced, and completed in a secure manner, his coffer-dam across half the river, by the fourth of June, and built the foundations of the bridge, and the piers within it, in the following manner. He first constructed frames of oak timber of ten inch scantling, the exact shape of the pier, with rough two-inch oak planks dove-tailed across it, in every three or four feet, and pinned to the frame; and on these planks he stretched other planks lengthways, but not so thick. These frames, so made, he had dragged to their proper situations, and let them rest upon the natural bed of the river. He next proceeded to the north abutment, which was an operation which he justly feared would be attended with very great danger, because he had a great depth to sink, and very little room to sink upon, without depriving the public of the carriage-way upon the north quay. He succeeded in combating the difficulties, and keeping up the breast of the bank or quay. He then strained a line, crossing the site of the proposed bridge at right angles, and ten feet from the back of the abutment, sinking about three feet, and driving in a row of piles close to the bank, which he pared so as just to admit the sheeting between the bank and the piles; and when they had sunk eight feet in this manner, he made his first effort, and so proceeded downwards. He then went on with his masonry for the continued foundation through the whole length of the bridge; and after many experiments found his coffer-dam to answer all his expectations. He thus proceeded carefully and judiciously, till he opened the bridge to the public in general, on the tenth of April, 1755, two years and eighty days after they were deprived of the use of the old bridge."

The usual way in which the foundations of Waterloo bridge, Southwark bridge, and Vauxhall bridge, have been laid, was by driving piles of Memel logs, fourteen or fifteen inches square, for the construction of the coffer-dams, which was cleared of water by means of pumps. See *Coffer-dam*, and *Caisson*.

Different writers have had very different opinions on the curve most convenient for the arches of a bridge. Dr. Hutton's arch of equilibration, which admits of a horizontal line at the top, according to his example in proposition 5, is of a graceful and convenient form, as it may be made higher or lower at pleasure, with the same opening. However, the result of pure theory was generally not successful in practice, owing to a variety of accidental circumstances which cannot be taken into account. The best practical arch appears to be the elliptical, as it can be made of any height to the same span, or of any span to the same height. This form of arch has a bolder look, is stronger, and requires less materials, than any other. Next to this, perhaps, is the cycloidal, and next the circular. Of the cycloidal there is a handsome example in the bridge of Trinity college, Cambridge.

The following observations are from the Tract of Seaward, on the rebuilding of London Bridge.—There are three several curves, which appear to combine in an essential manner, the advantages of beauty, and convenience of form, and which, from their decided superiority in this respect over all other curves, appear to be almost exclusively adopted for arches by the practical bridge-builder. These are the circular, the elliptical, and the cycloidal curves: which, with their infinite segments, present to our choice an endless variety of arches. The ellipse is most particularly advantageous in forming the intrados of an arch. At the springing of an elliptical arch, the curvature is considerable; and, as it rises perpendicularly, it affords the commodious opening, both as a water-way and as a passage for craft. Proceeding towards the crown of the arch, the curvature continually decreases, till it approaches almost to a parallelism with the horizontal lines of the bridge, by this means uniting all the boldness of the semicircle, with a light airy gracefulness of figure, which gives great relief to the more massy parts of the structure. The most admired bridges are generally those in which the springings of the arches commence immediately at the surface of the water. For it rarely happens that piers of any considerable altitude, as compared to their own bulk, or that of the adjoining masses, can be introduced to support the arches of a bridge; and, consequently, when they are employed, they generally fail of producing a good architectural effect, while, at the same time, they invariably tend to injure the appearance of the curve of the intrados. In cast-iron bridges, in which flat circular segments are generally employed for the arches, high piers are generally necessary to keep the springings of the iron voussoirs above the reach of the water. But the French engineers often remedy the bad effect, by giving to the sides of the piers the same degree of curvature as the intrados of the arch.

The stability of an arch will mainly depend upon the mass of materials employed in its construction. But this characteristic of an arch will be greatly modified in the three following ways:—first, by increasing or decreasing the depth of the voussoirs, the absolute weight of the arch remaining the same: secondly, by increasing or decreasing the density or weight of the materials, the depth of the voussoirs remaining the same: and, thirdly, by increasing or decreasing the curvature of the arch, the depth of the voussoirs, and the density of the materials, remaining the same. In the first case, by increasing the depth of the voussoirs, a great increase is obtained to the stability of the arch, for by that means the leverage of the voussoirs becomes so much greater, and is, therefore, much more efficient in resisting the tendency to vibrate. In the second case, by increasing the density or weight of the materials, the same advantage is obtained, because it is well known, that the motion given to a body by any force whatever, is always inversely as the quantity of matter contained in that body. Therefore, if the two foregoing circumstances be combined, that is, if the absolute weight of the arch increase at the same rate as the depth of the voussoirs, as is nearly the case in arches of stone, it follows, that the stability of the arch will increase in the duplicate ratio of the depth of the voussoir. In the third case, the stability of an arch is increased by diminishing the curvature: for this plain reason, that the increased lateral pressure which results from the diminished curvature, produces the same effect, as to the stability of an arch, as an increased density (or a greater quantity) of materials: it is precisely the same thing as increasing the tension of a cord, which always requires a proportionally greater force to cause it to vibrate. And this clearly proves, that, provided the abutments are adequate, the arches have, *cæteris paribus*, always more stability than arches of greater curvature. Therefore, as it is known, that in arches of stone, both the absolute weight and lateral pressure increase at nearly the same rate as the depth of the voussoirs, it follows that in such arches, of similar form and span, the stability will be nearly in the triplicate ratio of the depth of the voussoirs. To illustrate the above observations, we will refer to a few of our own most considerable bridges. The cast-iron arch over the river Wear, at Sunderland, is about the same span, and the same depth of voussoir, as the centre arch of the Southwark bridge in London. The former, however, has the greater curvature, and it is also formed with probably about one-third of the density or weight of materials employed in the latter. The consequence is, that in the Southwark bridge the vibrations are by no means considerable, while in the Sunderland bridge, they are what may be termed alarming oscillations. Again, let us examine the arches of Westminster, Blackfriars, and Waterloo bridges. In these, although the curvature is much greater than in the centre arch of the Southwark bridge, yet, as they are not more than half the span, have nearly the same depth of voussoir, and at the same time have a much greater density or weight of material, we shall find in them scarcely any perceptible vibration whatever. To some persons it may appear objectionable to compare iron arches with arches of stone, because the voussoirs of the first are generally formed in much larger parts than those of the latter. But if the subject be properly considered, there will be found no impropriety in comparing the two kinds of arches; for, as regards that kind of stability of which we are now treating, it matters not of what material, or of what size, the voussoirs are composed—the analogy will invariably hold good. It has long ago been shown by Gauthay, (in his Traité de Ponts et Chaussées,) that in the rupture of an arch, whatever may be the dimensions of the voussoirs in the direction of the curve of the intrados, it will always separate in a small number (generally four) of large fragments: therefore, the narrowness of the voussoirs in an arch of stone is of no consequence whatever, as regards its stability.

The depth of the voussoirs should always be determined by a direct relation to the span of the arch. But it does not appear equally clear, that it is necessary to have a reference to the lateral pressure also. "On the contrary, I think it may safely be laid down as a principle,—that in determining the depth of the voussoirs of an arch, it is not necessary that the lateral pressure or radius of curvature should be noticed in the first instance at all: for this plain reason, that if arches, of the size usually constructed, be formed according to the simple rule just mentioned, the depth of the voussoirs will always be of sufficient magnitude to resist the lateral pressure. Experience has pointed out many instances of the failure of an arch, from the equilibrium being destroyed: but, I believe, there is no instance on record of an arch failing by the absolute crushing of the materials."

Mr. Ware, in his "Treatise on the Properties of Arches," recommends the catenary as the best form. Dr. David Gregory, in a paper on the catenary in the Philosophical Transactions, 1697, asserts that none but the catenary is the figure of a true legitimate arch; and when an arch of any other figure is supported, it is because in its thickness some catenary is included. The catenary is the curve formed by a chain composed of links connected together, having a free motion in any direction at such connection, but inseparable. Mr. Ware has given a geometrical method of constructing the catenary. See Fig. x. plate AQUEDUCT OF NISMES. "To describe a catenary. From any points *a a*, of a curve AB, erect any equal vertical lines *a e*, *a e*, and draw the indefinite horizontal lines *e c*, *e c*, which intersect *a b b*, by the lines *a b*, *a b*, at right angles to the tangents at those points. Make *c b* equal to the line *e b*, and construct the similar triangles *c b d*. Through *d d*, draw the line required. Catenaries may be of as many forms as the gravities and shapes of the links in a chain may be varied. The catenary formed by similar and equal links will be formed from the circle, as in this proposition."

Mr. Ware makes the following conclusions at the end of the second section of his book. "When the extrados and intrados of a composition of lubricous forces in equilibrio in the same plane, are parallel, they must be right lines; as the direction of each of the forces must form the same angle with a horizontal line: no arch of equilibration, therefore, can have its intrados and extrados parallel. From this section it will be seen, that the extradoses of equilibration, of circular, elliptical, and cycloidal arches, are the most convenient forms for the entradoses of bridges: and thus nature, in this instance, has not been so much at variance with herself, as by her laws to prescribe a form to the extrados of a perfect arch, which is wholly inapplicable to the uses of mankind."

Mr. Ware has given sections from Trinity Church, Ely, King's College Chapel, Cambridge, and several cathedrals, in all of which the thickness of the columns and abutments are agreeable to what the catenary would lead to.

A practical instance of the equilibrium of the catenary is mentioned in the Encyclopedia Metropolitana. A scientific gentleman of Birmingham having occasion for a close factory for the manufacture of the article called Roman vitriol, set out a piece of ground to be covered by a brick arch of considerable length, the chord of which was eighteen or twenty feet, and its versed sine about twelve. He suspended a chain against a wall, the points of suspension being equal to the chord of his intended arch, and its depth equal to its versed sine. From a line traced from the chain, his carpenters made a centre, over which the bricklayers turned a single arch of nine inches only in thickness, without spandrels or other external support, its extrados being a curve parallel to its intrados, at a distance of only nine inches. It is a perfectly round and beautiful piece of construction. During an absence from home, he desired another to be built like it; the self-sufficient workmen varied the curve, to give it more room in its haunches, or a more graceful curve, and on striking the centre it fell.

The spandrels of the arch, or the spaces bewteen the haunches and road-way, are very commonly filled up with rubbish, or with masonry, which adds an unnecessary weight to the arch. Some, as in the Pont y Prydd, fill up the spandrels with apertures carried quite through, and kept open. Others turn counter arches, or tunnels, on and between the main arches, and conceal them by external masonry.

In the common bridge, where the weight tends to compress the arch; if the arch were only of a small depth, a slight force would derange it, and once deranged in a certain degree, it would fall. Hence, the arch must necessarily have a considerable depth to render it stable, and sufficiently firm for resisting the stress of a loaded waggon; but this increase of the depth of the arch, also increases the load to be supported, and, consequently, a much greater quantity of material must be employed than is necessary to resist the pressure in the direction of the arch. In a suspension bridge it is different, for to whatever degree the equilibrium of the chain be disturbed, it resumes its natural state as soon as the disturbing force ceases to operate. That is, it is endowed with the power of resisting any change of form by its arrangement, and no excess of material is necessary to preserve that arrangement. This is the chief advantage of a suspension bridge, and it is one of immense importance in construction of bridges of large span.

It has been remarked, that the suspension bridge is easily put together in model; it is joined with comparative simplicity of means on the large scale; and hence only a small expense is necessary for scaffolding in its first erection, and scarcely any is required for repairs. But for a common bridge, on the principle of compression, a very strong and accurate centre is necessary, to construct an arch upon; and the expense of centering and scaffolding is often greater than the whole expense of a suspension bridge for the same situation.

With a suspension bridge we can give an equally free space for the passage of vessels in every part of the width between the piers; for the road-way may be level, and all the space left clear between it and the water line; and hence it is better for a navigable river, than a common bridge where vessels are confined to the middle of the arch.

At Vienna, there has been erected a steel suspension bridge over the Danube. All the steel used in this bridge was manufactured immediately from decarbonated cast-iron, in Styria. The span is 234 feet, and the versed sine 15 feet. *It is the* work of M. Ignace von Mitis, who calculates the total weight of steel at less than half the weight of iron that would be necessary; or, that a steel bridge of half the weight of an iron one, would be the stronger of the two.

The general principles of equilibrium and stress are the same in suspension as in other bridges; in ordinary cases the load is very nearly uniformly distributed over the length of the bridge; and consequently, the curve assumed by the suspending chains will be nearly the same as the parabola. The stress in the different parts of the chains may be more accurately computed by a formula in Tredgold's Carpentry, art. 61; but for all practical purposes it will be sufficiently accurate to consider the curve a parabola, and compute them accordingly. The chains assume the form of the common catenary, only in the case where the road-way rests upon, and is of the same length as, the chains, which is a case of rare occurrence. Winch Bridge, across the Tees, is, however, one example. It appears to have been the common mistake of both scientific and practical men, to imagine, that the curve assumed by the chains of a suspension bridge is, in all cases, the common catenary; and it has caused the one class to embarrass themselves in complicated and useless investigations; while the other have had occasion to express their surprise at "the liability of the catenarian curve to alter, when loaded in the direction of the horizontal plane of the connecting road-way."

Other bridges have been erected, in which both the extending and compressing strains occur; as they do in the common drawbridge. The wire bridges of Galashiels and King's Meadows, in Scotland, are examples. In these the wires radiate from the points of suspension to equidistant points in the road-way. These radiating wires have to resist tension, while the sides of the road-way are compressed in the direction of abutments. This mode of construction has some good properties; for each half of a bridge may be erected, independently of the other, and a portion to act as a drawbridge in the centre, might connect them as a road-way, or open, as occasion required, to give passage to masted vessels. On this principle, we shall find no difficulty in extending a chain pier from one to two hundred feet over the sea, without being obliged to form a support at the extremity.

But, for a continuous bridge, it is a more simple and easy method to employ chains collected into masses of the form of the curve of equilibrium; the same strength is gained with the same quantity of material; and the bridge forms a more chaste and beautiful object.

From the valuable and highly interesting reports which were made by the Committee of the House of Commons appointed for inquiring into the practicability of erecting a bridge over the straights of Menai, the most important additions were made to our knowledge regarding the strength of materials in this department of bridge-building. With machines at the works of Captain Brown, and Messrs. Brunton, in London, a force of upwards of a hundred tons was exerted with the greatest ease and facility, and with an exactness and precision which was altogether astonishing in experiments of such magnitude. In one of these interesting trials at Messrs. Brunton's work on the Commercial Road, a strain was progressively applied to circular bolts of iron, till the machinery indicated a maximum of ninety-two tons. In this experiment, when the strain had amounted to sixty tons, it was observable that small particles of the oxide of iron began to separate on the surface, and when the hydraulic machine was wrought up to a pressure of seventy-five tons, the part which ultimately separated and gave way, became sensibly smaller, its temperature was also somewhat increased; and when the register of the machine indicated ninety-two tons, it suddenly parted, or broke asunder. This trial was made with a rod of Welsh iron, which, on examination, appeared not to be of the first quality.

In chain bridges of great extent, no danger is to be apprehended from the ordinary weight of the passing load. But in projects of this kind, it becomes necessary to consult the safety of the fabric in extensive cases, by taking into calculation the crowded state of the road-way, when a multitude of people, or a drove of cattle, passes it. We find that a given area closely covered with men, will have a greater weight than the same space closely occupied by cattle in the proportion of about nine to seven: and every one knows that a drove of cattle is more likely to be gradually admitted upon the road-way of such a bridge than a mob of people whom objects of interest attract to a particular spot. Cf this a remarkable instance occurred at the opening of Captain Brown's bridge over the Tweed in July, 1820, when it was intended to keep the road-way clear for the ceremony of the day; a crowd of people broke through every obstruction, and forced their way upon the bridge, and it was estimated that at one time there were about seven hundred people upon the road-way. Now, taking each person of this number at one hundred and fifty pounds, it would give about forty-seven tons, besides its own weight, which it sustained, without any apparent derangement.

The main chains of the Union bridge are formed of circular rods of iron, measuring about two inches in diameter; and a bar of that strength, which was not considered of the first quality, sustained a force equal to ninety-two tons. As the number of catenarian chains in the Union bridge are twelve, if we estimate the strength of each rod with its shackle at ninety-two tons, we shall have the aggregate strength of the whole to be 92 × 12 = 1104 tons. We have already supposed the weight of the bridge, between the points of suspension, to be one hundred tons, and if to this we add forty-seven tons as the greatest load which is likely to be ever brought upon it at once, these together give 100 + 47 = 147, or say, one hundred and fifty tons. Assuming the angle of suspension at twelve degrees, we find that the real weight is increased to about three hundred and seventy tons of tension on the catenarian chains. But as we find the strength of these chains to be one thousand one hundred and four tons, there remains a surplus strength of about seven hundred and thirty-four, or, in round numbers, seven hundred tons, to resist any emergency beyond a weight of fifty tons.

But the effect we have to provide against in bridges of suspension is not merely what is technically termed *dead-weight*. A more powerful agent exists, in the sudden impulses, or jerking motion, of the load. The greatest trial, for example, which the timber bridge at Montrose, about five hundred feet in extent, has been considered to withstand, is the weight of a regiment of foot, passing in *regular time*. A troop of cavalry, on the contrary, does not produce corresponding effects, owing to the irregular step of the horses. The same observations apply to a crowd of persons walking promiscuously, or to a drove of cattle, which counteract the undulating and rocking motion, observed on some occasions at the bridge of Montrose, when infantry has been passing along it. Hence, also, the effects of gusts of wind, often and violently repeated, which destroy the equilibrium of the parts of a bridge of suspension; and the importance of having the whole road-way and side-rails framed in the strongest possible manner.

Among the finest of the modern stone bridges may be reckoned the New London Bridge across the Thames, of five elliptical arches. The design was given by the late Mr. John Rennie, and it was built under the direction of his sons, John and George Rennie. The materials are principally Scotch granite. Our plate will give a better idea of it than any description that we could give. The dimensions are as follows.

	feet.
Span of the centre arch	150
Rise (above the level of the high-water mark of the Trinity house)	29½
Piers adjoining the central arch, each	24
Span of the arches next the centre one	140
Rise	28½
Piers, each	22
Span of the arch next to the abutments	130
Rise	25
Abutments	74
Total length of the water-way	690
Length between the abutment	782
Total length, including the abutments	930
Width of the carriage-way	36
Width of the bridge	56*

* See Supplement.

Bridge-board. See *Notch Board.*

Bridge-over. When any number of parallel timbers have another piece of timber fixed over them, in a transverse direction, then the transverse piece is said to *bridge-over* the pieces which are parallel. The common rafters in framed roofing, for example, bridge over the purlins; and, in naked flooring, the upper joists to which the flooring boards are fixed, bridge over the binding joists, and, therefore, are called *bridging-joists.*

Bridge-stone. A stone laid in a horizontal direction over an area, extending from the pavement to the entrance door of a house, and not supported by an arch.

Bridge-gutters. Gutters made with boards, supported beneath with bearers, and covered above with lead.

Bridging-floors. Floors in which bridging-joists are used. See *Naked Flooring.*

Bridging-joists. Pieces of timber, or joists, in naked flooring, extending in a direction parallel with the girder, and supported by beams called binding-joists, which lie in a transverse direction. It is to the bridging-joists that the floor-boards are nailed. See *Naked Flooring.*

Bridges, or bridging pieces. See *Straining-pieces* and *Strutting-pieces.*

Bringing-up, or carrying up. A term used by workmen, and is analogous to building-up; for example, bringing-up the wall 3 feet, means building-up the wall 3 feet.

Brizio, or Briccio, Francesco. A painter of architecture, and landscape, was born at Bologna, in 1574, and educated first in the school of Passerrotti, and afterwards under Ludovico Caracchi. Having applied with great diligence to the study of the principles of perspective and architecture, he acquired a style in his compositions of such distinguished excellence, that his pictures were much admired, not only for the truth of the perspective, and the beauty of the colouring, but also for the grandeur of his ideas, the majestic style of the architecture, the elegance of the ornaments, and the noble taste of landscape which he introduced to set off his buildings. He was also an engraver, and is said to have assisted Agostino Caracchi in the plates which he engraved: we have also some etchings by this master. He died in 1623.

Broad-stone. The same as freestone.

Bronteum. *In Grecian Antiquity.* That part of the theatre, underneath the floor, wherein brazen vessels, full of stones and other materials, were kept, to imitate the noise of thunder.

Bronze. A compound metal, used for statues, busts, and medals. According to Pliny, the metal used by the Romans for their statues, and for the plates on which they engraved inscriptions, was composed in the following manner:—they first melted a quantity of copper, into which they put one-third of its weight of old copper, which had been long in use; to every one hundred pounds weight of this mixture, they added twelve and a half pounds of an alloy, composed of equal parts of lead and tin. Another bronze may be made by compounding together seven pounds of pure copper, three pounds of zinc, and two pounds of tin. In making this last, the copper must be fused before the other ingredients are added.

Bronze. This term is also applied to any piece of sculpture made of bronze metal. See *Casting*.

Brooch. A painting all in one colour.

Brown. A dusky kind of colour, inclining somewhat to redness. Of these there are various shades and gradations:—as sad brown, London brown, clove brown, purple brown, and walnut-tree brown. The brown colours are bistre, brown ochre, Cologne earth, ombre, and brown pink. Spanish brown is a dull red colour, used by house-painters, chiefly for priming.

Brunelleschi, Philip. An eminent Italian architect, was born at Florence, in 1377; and in early life, having a taste for mathematics and mechanics, and a desire to learn sculpture, he became acquainted with Donatelli, a rising artist in that profession. Brunelleschi accompanied Donatelli to Rome, in order to survey the monuments of architecture and sculpture in that capital. Brunelleschi employed the whole of his time, during his stay in Rome, with indefatigable assiduity, in making drawings, and taking measures of all the famous relics of antiquity; and having conceived a design of establishing his fame, by erecting, on a new plan, a dome for the cathedral of St. Maria del Fiore, at Florence, he remained in Rome after the departure of his friend, in order to qualify himself for this undertaking. Having been in his youth apprenticed to a goldsmith, he now found the knowledge he had acquired of that business, useful in procuring him a maintenance. In 1407, sickness obliged him to return to Florence; and at this time the Florentines had convoked an assembly of architects and engineers, to deliberate on the completion of the cathedral. Brunelleschi gave his opinion that a double dome might be raised to a sufficient height, without that immense mass of timber-work which others had thought to be necessary. This idea was considered so preposterous, that he was actually turned out of the assembly, for having presumed to insult the good sense and judgment of so many experienced artists, who had never heard of such a thing, and held it to be impracticable. Brunelleschi demonstrated the practicability of his scheme, by drawings and models; but the clamour raised against him ran so high, that he was looked upon as little better than a madman. He, therefore, returned to Rome. The deputies, however, who were intrusted with the management of the building, having received nothing eligible from the other architects, sent for Brunelleschi; and, having examined into his drawings and models, employed him in the execution of the work. He proceeded in it with ardour, and lived to complete the dome as far as the lanthorn; carrying it to such a height, and executing it with such beauty, as astonished the whole country. Such, indeed, was the beauty with which it was executed, that Michael Angelo afterwards said it would be very difficult to imitate, and perhaps impossible to surpass it. Brunelleschi was also employed by Cosmo the Great, in building the abbey of canons regular at Fesoli, and in forming for him the model of a palace, which his prudence and moderation would not allow him to execute. As Cosmo preferred the more humble plan of Michelozzi, Brunelleschi was so indignant, that he destroyed his model, though its superiority was acknowledged by Cosmo. He afterwards undertook the construction of the Pitti palace, and carried it up to the second story; but the completion of it, after his death, was the work of Ammanati. The church of St. Lorenzo, in Florence, was almost entirely the work of Brunelleschi. He was no less skilled in military than in civil architecture. In this department, he gave to the duke of Milan, the plan of a fortress for his capital; and he also contrived the two citadels of Pisa, and other fortifications in that part of Italy. As a civil engineer, he was employed in 1445, by the marquis of Mantua, in constructing dykes for restraining the Po to its bed. Soon after the completion of the work, he died, at the age of sixty-nine, much regretted by his brother artists, and more so by the poor, to whom he was a father. His merit was more generally acknowledged after his death, than during his life; for he had the mortification of seeing several of his undertakings left unfinished for want of due encouragement. Brunelleschi was also a cultivator of Italian poetry; and some of his burlesque verses have been printed along with those of Burchiello.

Budget. A kind of pocket used by bricklayers for holding nails, when they lath for tiling.

Buffet. See *Beaufet*.

Builder. A person who contracts to build or erect edifices.

Building. Under this article we shall give the usual form of drawing up the specification of a building, and in the next article, *Building*, give some general observations on the construction of edifices in general.

Specification and description of the works to be contracted for, in building and completely finishing a new court-house, with offices, house of correction, &c. at
according to various plans, elevations, and sections, &c. made by
architect, and referred to in a contract, bearing date the
day of
and made between
and

Bricklayer's work, &c. Dig out the ground to the depths and widths necessary for all the walls, iron pipes, drains, cesspools, &c.; also for the cellars under the keeper's house, bath, and receiving rooms, and prisoners' passage leading to the court. Fill in and ram the ground to the foundations. Dig out the loose earth in the prisoners' airing courts, yards, and all other parts which are described to be paved with brick or stone. Fill in and ram the same to the necessary height with dry rubbish to the current, described for the said paving; also under the drains and cesspools, described in the drawings. Stub up the edge, and level the bank and ground next turnpike-road. Dig out a cesspool, of at least 15 feet diameter, at the outer end of the 18-inch drain, outside of the boundary wall, and 5 feet below the bottom of said drain. Clear and cart away all superfluous earth arising from these excavations. The remainder of the ground to be levelled after the whole of the works are completed, as will be directed by the architect, or his clerk of the works.

The whole of the walls, with the several piers, arches, string courses, &c., are to be carried up in the manner shewn, and of the heights and thicknesses figured or described on the drawings. Flues are to be built 14 inches by 9 inches, where shown on the drawings, and to be well pargetted; those for the two kitchens are to be 14 inches square. Second size chimney-pots, properly bedded, are to be placed over all the flues: eight are to be provided and fixed, of composition three quarter inch thick, with moulded tops 1 foot square in clear, diminished to 10 inches square, and 30 inches in height: these may be had at the cement manufactories in London.

Small openings for air and ventilation are to be left through the basement walls of the different buildings, as shown in the drawings, or where required or directed by the architect, or his clerk of the works.

Build brick piers and sleepers for the stone paving under the portico, spectators' seats in the court, and over the spandrels of the arches to the vaults, and under all the joints of the internal stone paving, throughout the remainder of the buildings, and where otherwise described on the drawings.

Build brick piers for the stone steps to the portico, and to the several doorways shown on the drawings, and where thought necessary. Half-brick trimmers are to be built to all the chimneys where there are wood floors, and brick fenders to slabs where shown on the drawings.

Small cesspools are to be made to the different privies marked in the drawings, those to the prisoners' airing courts to be constructed according to drawing, with traps and stone-work; the stone for which is to be provided by the mason, but to be fixed by the bricklayer; the sides of the openings, under the cocks and traps, to be worked and lined with cement, and to be rounded off at the openings of the drains.

Cesspools are to be made under all the iron gratings in the court-yards and airing courts, and under every stack of rain-water pipes (excepting those which fall into the privies,) to be lined with cement, and trapped with York stone, the stone to be provided by the bricklayer; those to the rain-water pipes, 14 inches square, and 2 feet deep; those to the gratings, over 9-inch drains, 14 inches square; and those to the 14-inch drains, 18 inches square; the whole of them to be 1 foot deeper than the bottom of the drains. A cesspool to be dug and steined, as before described, to the junction of the 14-inch drains beyond the mill-house, 3 feet 6 inches by 2 feet 6 inches in the clear, and 2 feet deeper than the bottom of the drains.

Three wells for the pumps in the airing courts, where shown on the drawings, to be dug and steined in half-brick, 4 feet diameter in the clear, and 20 feet deep, as may be required, and arched over with one brick in mortar. Build 9-inch, and 14-inch barrel drains, with half-brick rims in mortar, where described or shown in the drawings; also 140 feet of 18-inch barrel drain, beyond boundary-wall, and from cesspool last described, as shown or described on drawing. The whole of the drains throughout the buildings to be laid to a current of not less than 3 inches in every 10 feet in any part.

Pave the hay and straw room adjoining the magistrates' privy, the dungpit in the stable court, the coal-hole adjoining counsels' privy, the prisoners' passage leading to court, the coal and dust vaults under the bath and receiving rooms, and the rooms and passages in the basement under the keeper's house, with hard-burnt stocks on edge laid in sand; the ground to be well rammed to receive the same, and the whole laid to the necessary current, which may be described by the architect, or his clerk of the works.

Build an oven for purifying the prisoners' clothes in the receiving room, where shown on the drawings, as will be directed by the architect, or his clerk of the works, with all the necessary iron work, which is also to be provided by the bricklayer. Wrought iron chimney bars to all the chimney openings, 2 inches wide, and a quarter of an inch thick, and to lie 6 inches on each jaumb, to be provided and fixed by the contractor for the bricklayer's work.

Cut all splays, birds-mouths, skewbacks, &c. which may be required; bed and point all plates, door, and window frames, &c. which may be required. Provide and lay splayed bricks, and 14-inch circular coping bricks, where shown or described on the drawings, or found necessary in the execution of the works; build all footings for iron kirbs, and fill in the same with brick-work well flushed with mortar.

The whole of the front buildings next turnpike road, including the recess of prisoners' entrance, corresponding blank entrance, and return, 3 feet 6 inches wide, to boundary wall, excepting the parts described of stone, to be faced with the best white Suffolk bricks, laid with a neat flat joint; those to the returned splays of the prisoners' entrance, and blank ditto, to be made to a mould on purpose. The walls are to be carried up together all round the different buildings, unless orders are given to the contrary, by the architect, or his clerk of the works, the whole being made truly level, straight, and perpendicular, no four courses of which are to rise more than 11¼ inches. The inside of the walls, which are not described to be plastered, are to be left with an even surface, and the joints properly pointed with mortar for lime-whiting, and the whole of the brick copings to be worked and pointed with Roman cement.

All the brick-work to be done with the best hard-burnt and sound kiln-burnt stocks, to be approved of by the architect, or his clerk of the works. Brick earth may be procured by the contractor, on very reasonable terms, within a quarter of a mile of the work. Picked bricks to be selected and used for the front of the keeper's house, and the string courses; also the inside of court, and any other part which may be directed by the architect.

The best and most even bricks to be selected for the outside of the buildings generally, and where otherwise exposed to sight. The brick-work must be tied in every course, and worked in sound and regular bond. The filling in, or internal parts of the walls, to be filled up solid with whole bricks. The whole to be well bedded, and flushed up at every course. The whole of the footings, every second course above them, and under the set-off of the ground-floor, and every fourth course above it, to be well grouted with hot liquid lime and sand.

The bricklayer is to flush in, and back close with sound bricks and good mortar, behind all ashlering cornices, and other stonework; and to make good, and key in up to all materials connected with his work, and to point up home to all coping, sills, and other projections.

Frame and fix a lean-to roof over the privy and lobby adjoining the magistrates' room, with rafters 5 inches by 2 inches, rising plate 4 inches by 3 inches, and pitching piece 4 inches by 2½ inches. Cover the same with inch battens, featheredge eaves boards and tilting fillets, as before described for the other roofs. Frame and fix ceiling joists to privy and lobby 3 inches by 2 inches, with plates 4 inches by 2½ inches.

Frame and fix a lean-to roof over the stable, chaise-house, dead-house, &c. according to the drawings, and with timbers of the following scantlings:—

Rafters - - - - -	5×2
Purlins - - - - -	6×4
Struts and templates to ditto, where necessary -	4×2½
Rising plate - - - -	4×3
Pitching piece - - - -	4×2½

Frame and fix a span roof over the outside lobby, corresponding with that of the prisoners' entrance, with rafters 4 inches by 2 inches; rounded ridge 6 inches by 2 inches, with templates at each end of the same; wall plates 4 inches by 2½ inches. Cover the same and the last named roofs with inch deal battens, featheredge eaves boards, and tilting fillets, as before described for the other roofs.

Frame and fix ceiling joists over the stable 3 inches by 2 inches, with a binder 5 inches by 4 inches, and templates for ditto, and wall plates 4 inches by 2½ inches. Provide for one and a half tier of bond round the walls, to be laid as may be directed for the fittings of the stable.

Frame and fix roof over the chapel according to the drawings, and with timbers of the following scantlings:—

Ridge piece rounded for lead - - - - -	8×2
Hips, ditto - - - -	11×2
Common rafters, with feet notched and tailed on wall plate as before, and nailed with 6-inch two shilling nails - -	5×2
Purlins - - - - -	9×5
Pole plate with blockings	4×3
Wall plates to be in long lengths, not less than 25 feet, properly scarfed at the meetings, securely halved and pinned at the angles, the ends to tail on within 4½ inches of the external face of the wall -	9×6
Principal rafters, average	9×8
Collars - - - - -	8×8
Queen posts - - - -	8×8
Braces - - - - -	8×6
Tye beams in one piece to camber 2 inches -	12×9
Struts to purlins - - -	5×4
Angle tyes and dragon pieces, dovetailed to plate - - - - -	5×4
Binders to ceiling - -	7×4
Ceiling joists - - - -	3×2

Provide and fix wrought iron straps with bolts, &c. to the feet of principal rafters, and top and bottom of queens, as shown on the drawings at large. Cover the roof with inch deal battens, 2½ inches wide, laid to a gauge for countess slating, with proper featheredge eaves boards, and three quarter inch tilting fillets, 3 inches wide, for slaters, with inch deal gutters, and bearers adjoining the chimney shafts.

Frame and fix the roofs over the prisons according to the drawings and with timbers of the following scantlings:—

Ridge-piece rounded for lead - - - - -	8× 2
Hips and vallies ditto -	11× 2
Common rafters with feet notched and tailed on wall plate as before,	

Common rafters, with feet notched on pole plate, and nailed with 6-inch two shilling nails	6×2¼
Middle rafter to hip end, framed into ridge of portico	7×4
Purlins	6×4
Pole plate, with blockings	4×3
Wall plates all round to be in long lengths, not less than 25 feet, properly scarfed at the meetings, securely halved and pinned at the angles, the ends to tail on the wall within 2½ inches of the external face	9×6
Principal rafters, average	9×6
King post	8×6
Braces	6×4
Tye beams in one piece, to camber 2 inches	12×6
Binders to ceilings	6×4
Ceiling joists	4×2

Provide for 10 feet cube of framed fir in roof for ventilators and chandelier, where will be directed. The carpenter is to assist the smith in fixing the ventilators. Provide and fix wrought-iron straps, bolts, &c. to bottom of kings, and feet of principal rafters, as before described for the roof of portico. Provide and lay inch deal battens, 2¼ inches wide, to a gauge for countess slating, with proper featheredge eaves boards, valley pieces, and three quarter inch tilting fillets, 3 inches wide, for slaters.

Prepare and fix rounded rolls, 2½ by 2 inches, to ridge and hips, with proper irons for the same.

Provide and fix bracketting for plaster cornice in court room. Provide and fix a chain plate at the impost moulding of the court room, 6 inches by 4½ inches, properly scarfed at the meetings, and three tier of bond, 4 inches by 2½ inches, where will be directed by the architect.

Frame and fix a 4-inch quarter partition at the back of the spectators' seat, forming a passage, with head and sill 4 inches by 3 inches; principal posts 4 inches by 3½ inches; braces 4 inches by 2½ inches; and common quarters 4 inches by 2 inches; the quarters 1 foot from centre to centre.

Frame and fix ceiling joists over ditto, 4 inches by 2 inches, with three-quarter inch ploughed and tongued boarding, planed one side.

Frame and fix joists from 8 inches to 6 inches, by 2¼ inches, with plates 4 inches by 3 inches, in the court room to the necessary heights shown on the drawings, except the passages and spectators' seats, which are to be paved with stone, and are distinguished by a blue tint on the drawings.

Frame and fix lean-to roofs and ceiling joists over the lobbies to the side entrances leading to the officers' apartments adjoining the courts, according to the drawings, with timbers of the following scantlings:—

Common rafters, with feet notched	4×2
Plate	4×3
Pitching piece	4×3
Purlin	5×4
Ceiling joists	4×2
Wall plate	4×2½

Cover the aforesaid roofs with inch deal battens and tilting fillets, as before described for the other roofs.

Provide and lay two tiers of bonds 4 inches by 2½ inches, round each of the said lobbies.

Frame and fix the roofs to the side-wings adjoining the court room, and forming the officers' apartments, according to the drawings, with timbers of the following scantlings:—

Ridge piece - - - -	9×2
Common rafters, with feet notched on pole plate, &c. as before -	5×2
Trimming ditto to skylights - - - - - -	5×3
Purlins - - - - - -	6×4
Pole plate with blockings	4×3
Wall plates, as described for the court roof - -	6×4
Principal rafters, average	8×6
King posts - - - -	8×6
Braces - - - - - -	6×4
Tye beams, in one piece	10×6
Angle tyes and dragon pieces - - - - - -	6×4
Binders to ceiling - -	6×4
Ceiling joists - - -	4×2
Trimming ditto - - -	4×3

Provide and fix wrought-iron straps, bolts, &c. to bottom of kings and feet of principal rafters as before described. Cover the roofs last described with inch deal battens, 2¼ inches wide, to a gauge for countess slating, with proper featheredge eaves board and tilting fillets, 3 inches wide for slaters. Prepare and fix rounded rolls 2¼ inches by 2 inches, to ridge and hips with proper irons for the same.

Provide and lay inch deal gutters, with edges shot, and proper bearers for the same.

Prepare and fix 1¼-inch deal ovolo sashes, and 1¼-inch wrought one side, and staff beaded linings to the ceiling; and 2-inch square, straight, bar skylights, with one quarter wrought linings to the roofs, where shown on the drawings, with fillets and fastenings to same, the sashes in the ceiling to be hung on pivots, and to have a moulded stop.

Frame and fix 6-inch quarter partitions to grand jury room, with heads and sills 6 inches by 3½ inches; principal posts and quarters, 6 inches by 4 inches; braces and door-heads, 6 inches by 3 inches; and common quarters, 6 inches by 2½ inches.

The remaining rooms to the side wings to have 4-inch quarter partitions, with heads and sills 4 inches by 3 inches; principal posts and quarters, 4 inches by 3½ inches; braces and door-heads, 4 inches by 2½ inches; and common quarters, 4 inches by 2 inches; the quarters, 1 foot from centre to centre.

Frame the floors of the side wings adjoining the court as before described, with joists 7 inches by 2½ inches, and oak sleepers and plates 4 inches by 3 inches. Provide for two tier of bond, laid complete throughout the rooms of the wings last described, exclusive of the wood bricks required for the window skirting, &c.

Frame and fix the roof over the hospital, bath, and receiving rooms, &c. according to the drawings, with timbers of the following scantlings:—

Ridge piece - - - -	9×2
Common rafters, with feet notched on pole plate, as before described -	5×2
Purlins - - - - - -	6×4
Templates to ditto - -	4×4½
Struts to ditto - - -	4×3
Pole plate with blockings	4×3
Wall plate, as described for the court roof - -	6×4
Principal rafters, average	8×6
King post - - - -	8×6
Braces - - - - -	6×4
Tye beams in one piece -	10×6
Binders to ceiling - -	6×4
Ceiling joists - - -	4×2
Trimming ditto - - -	4×3

Provide and fix wrought-iron straps, bolts, &c. to bottom of king and feet of principal rafters, as before described; cover the roofs last described with inch deal battens 2¼ inches wide, to a gauge for countess slating, with proper featheredge eaves boards, and tilting fillets, 3 inches wide for slaters. Prepare and fix a rounded ridge roll 2½ inches by 2 inches, with proper irons to the same.

Frame the floors of the infirmaries and rooms adjoining, with joists 7 inches by 2¼ inches, and trimming ditto 7 inches by 3 inches, and wall plates all round the walls 6 inches by 4 inches, securely spiked at the angles. Provide for one tier of bond, laid completely round the last named rooms, exclusive of wood bricks required for skirtings, windows, &c. Frame and fix 4-inch quarter partitions, forming passages as shown in drawings, with heads and sills 4 inches by 3 inches; principal posts and door posts, 4 inches by 3 inches; braces, 4 inches by 2½ inches; and common quarters, 4 inches by 2 inches; the quarters 1 foot from centre to centre.

Frame and fix lean-to roofs to the privies in the yards adjoining the bath and receiving rooms, with rafters 4 inches by 2 inches, rising plates 4 inches by 2½ inches, and pitching pieces 3 inches by 2 inches. Cover the same with inch deal battens 2¼ inches wide, laid to a guage for countess slating, with proper featheredge eaves boards, and tilting fillets, 3 inches wide. Frame and fix a roof over the store-room, coal-hole, and privy, adjoining the counsel's room, with rafters 3 inches by 2 inches, rising plate 4 inches by 3 inches, and pitching piece, 3 inches by 2 inches; purlins, 5 inches by 3 inches; templates for the same, 2 feet long, 4 inches by 2½ inches. Cover the same with battens for slates, eaves boards, and tilting fillets, as last described. Provide for one tier of bond, 4 inches by 2½ inches round the walls, exclusive of the necessary wood bricks required for the windows, &c.

Frame and fix a roof over the prisoners' entrance with rafters 4 inches by 2 inches, rounded ridge 6 inches by 2 inches, with templates at each end, and plates 4 inches by 2½ inches. Cover the same with inch deal battens, 2¼ inches wide, laid to a gauge for countess slating, with proper featheredge eaves board, and tilting fillets 3 inches wide. Provide and lay inch yellow deal gutters, edges shot with proper bearers to the same.

Frame and fix a lean-to roof and ceiling joists over the keeper's lodge, bed-room, wash-house, and waiting cell, according to the drawings, and with timbers of the following scantlings:—

Valley piece - - - -	7×2
Rafters - - - - -	4×0
Purlins - - - - -	6×4
Struts to ditto - - -	4×3
Wall plate - - - -	5×4
Pitching piece - - -	4×2½
Binders to ceiling - -	6×4
Ceiling joists - - -	3×2
Templates to wall plates, purlins, and binders, where necessary - -	4×2½

Cover the same with inch battens, eaves boards, and tilting fillets, as before described.

Provide and fix one tier of bond throughout the last named rooms, exclusive of wood bricks, which may be required for the window, &c. Frame and fix floor joists to the bed-room, 5 inches by 2¼ inches, with plates 4 inches by 2½ inches.

Frame and fix a lean-to roof over the privy. with rafters, rising plate, and pitching piece, inch battens, eaves boards, and tilting fillets, as before described for the privies.

All the mortar to be compounded of lime from
and sharp-screened sand from
or of equally approved quality, perfectly free from salt, and in such proportions as the architect, or his clerk of the works, shall direct; not less than two bushels of lime to three bushels of sand: the lime to be screened with the sand, and ground through a pugging-mill, at the contractor's expense.

The lime brought upon the ground is to be kept under an enclosed shed, so as not to be injured by exposure to the air; and no more is to be made at any time than is sufficient for the day's consumption.

The contractor for the bricklayer's work is to find straw, or other materials and labour, for securing the work from the weather, should it be considered by the architect, or his clerk of the works, necessary at any time so to do. He is also to find all the scaffolding necessary for the performance of the brick-work above described, and all other works required; the same to be erected in a substantial and efficient manner to every part of the buildings; and shall from time to time remove and secure the same as the architect may require. And when the whole of the works are completed, he is to take down and remove the same from the ground at his own expense. He is also to fill up all putlog holes, taking particular care in matching the bricks and mortar. And it is to be observed, that no putlog holes will be allowed where there is stone ashlering; and he is to attend the mason, carpenter, and all other workmen, to properly back in behind all stone-work, and make good after the several workmen, when and where required.

The boundary wall to be built within two months after the signing of the contract, in order to enclose the buildings whilst the several works are in progress.

Carpenter and Joiner. Provide and fix a secure board, with rough close fencing, at least 7 feet high, to enclose the front part of the building where shown by the dotted lines tinted yellow on drawing No. 2, with proper folding gates 8 feet wide, and a wicket gate and enclosed box in one of them, for a gate-keeper; the said gates to be provided with secure fastenings. Provide and fix also a small shed building, about 12 feet long and 7 feet wide, as a counting-house for the clerk of the works, adjoining the said hoard, or any part within the premises, as may be directed by the architect. The building to have a small fire-place, a casement window 6 feet long, with ledged shutters, and a desk 3 feet wide, the whole length of the counting-house, with two drawers, and to be floored, and to have a ledged door, with a good lock, &c.

Provide and fix also an enclosed shed for the lime, with door, &c. as will be directed, and in such part of the premises as may be thought necessary. The whole of the aforesaid temporary works may be made of any description of old materials, but must be kept standing, and in repair, till the whole of the buildings are enclosed in every part with windows, doors, &c. The counting-house must be kept standing, and in repair, till the works are entirely finished, when the whole of the aforesaid temporary works must be removed, and the ground cleared and levelled at the contractor's expense. Provide for enclosing such doors, windows,

&c. for the plasterer's work, or other cause, and casing stone and other work to the necessary height, to prevent injury to them during the progress of the work, as may be required from time to time by the architects, or his clerk of the works.

Provide and fix all requisite moulds for cutting the inverted arches. Provide and fix all requisite moulds, turning-pieces, and centering for the bricklayer and mason, which may be necessary for their work. No part of the centering is to be removed, and no plates or bond are to be cut out of the openings until directions are given for that purpose by the architect, or his clerk of the works.

Provide and fix wood bricks to all the wood jaumbs, linings, skirtings, and window frames; also lintels over the wood frames and doors the whole width of the walls, and within 9 inches of the outside face of the external walls, except where intercepted by stone heads, described in the drawings. Also filling in lintels, or where required by the architect, the lintels to lay on the walls not less than 9 inches at each end, and to be 6 inches thick. Provide and fix wood blockings for hinges and locks where required.

Provide and fix wrought-iron bars 2¼ inches by ½ inch, connecting the plates in a secure manner where the flues intercept the same throughout the different buildings.

Frame and fix the roof of the portico according to the drawings, with timbers of the following scantlings :—

Ridge piece - - - -	9×2
Common rafters, with feet notched and tailed on pole plate, as shown on drawing, and nailed with 6-inch two shilling nails - - - - - -	5½×2¼
Pole plate - - - -	6×4
Gutter plate, with bevelled top - - - -	4×3
Purlins, notched and spiked to templates - -	6×4
Templates for ditto, at each end 3 feet long -	4×3
Strut to ridge piece - -	4×3
Wall plates all round, securely halved and pinned at the angles, the ends to tail on the wall within 4½ inches of the external face - - -	9×6
Principal rafters average	7½×6
Collar - - - - - -	6×6
Queens, average - - -	8×6
Tye beam to camber 1 inch - - - - - -	8×6
Struts or braces - - -	6×4
Ceiling joists - - -	4×2
Plates for ditto - - -	4×3

Provide and fix wrought-iron straps to the bottom of the queens, and ends of principal rafters, 2 inches wide and half an inch thick, with a screw bolt and nut, two drafts and iron wedges to each as shown in a drawing at large.

Cover the roof with 1¼ inch yellow deal boarding, close jointed for lead. Prepare and fix rounded rolls to ditto, and a rounded roll, 2½ inches by 2 inches, securely fixed to the ridge with proper irons.

Provide and lay inch yellow deal gutters, with edges shot, and proper bearers at each end. Frame and fix double binders, 9 inches by 4 inches, with filling in joists, &c., as shown in the drawings, for the stiles and rails in the ceiling of portico. Frame and fix the roof of the court-house, according to the drawings, with timbers of the following scantlings :—

Ridge piece - - - -	9×2
Valley piece to hip end -	8×3

and nailed with 6-inch two shilling nails	4×2
Trimming do. to chimneys	4×3
Purlins	5×4
Tyes, collars, and struts to purlins every 7 feet apart, with blockings where necessary, the whole securely pinned and nailed together, and the struts wedged at bottom, as shown on the drawings	4×3
Wall plates to be in long lengths, not less than 25 feet, properly secured at the meetings, and securely halved and pinned at the angles, the ends to tail on the walls within 4½ inches of the external face	9×6
Angle ties and dragon pieces dovetailed to plate	6×4

Cover the roofs last described with inch deal battens, 2¼ inches wide, laid to a guage for countess slating, with proper featheredge eaves boards, and three quarter inch tilting fillets, 3 inches wide for slaters. Provide and lay inch deal gutters and bearers adjoining the chimney shafts.

Frame and fix a ceiling over the prisoners' staircases, with a binder 6 inches by 4 inches between the purlins and templates for ditto, and ceiling joists 5 inches by 2 inches. The rafters of the roof to form the remainder of the ceiling.

Frame and fix the floor of joists to the chapel according to the drawings, and with timbers of the following scantling:—

Joists	7×2¼
Trimming ditto	7×3
Joists over the front rooms and passages adjoining	9×2¼
Struts between ditto	9×2¼
Trimming joists	9×3
Binders over matron's room and keeper's back room to be planed three sides	12×6
Sleepers on cross walls	4×4
Wall plates halved and spiked at the angles, and scarfed at the meetings, and to be in long lengths, as described for the roof plate	6×4

Frame and fix proper bearers to raise the floors under the pulpit, reading-desk, clerk's seat, and keeper's and matron's pews, to the height and in the manner shown or described on the drawings. Frame and fix a quarter-partition, enclosing the chapel stairs with head and sill 4 inches by 3½ inches, door-posts and principal quarters 4 inches by 3 inches, braces and common quarters 4 inches by 2 inches, the quarters to be 1 foot from centre to centre.

Provide and lay two tier of bond 4 inches by 2½ inches round the walls of the chapel, where will be directed, exclusive of the wood bricks which may be required.

Frame and fix the floor of joists to the one-pair story of the keeper's house, according to the drawings, and with timbers of the following scantlings:—

Joists	7×2¼
Trimming ditto	7×3
Joists to front rooms and passages	9×2¼
Trimming ditto	9×3
Struts between ditto	9×2¼
Binders over back rooms to be planed three sides and chase-mortised for joists	12×6
Plates on cross walls	4×4
Wall plates all round, halved and spiked at the angles, and to tail on the wall within 4½	

inches of the external face	6×4

Provide and lay two tier of bond round the sides of the rooms in the one-pair story last named, where will be directed, exclusive of wood bricks required for fixing skirting, windows, &c.

Frame and fix the floors of the front rooms and entrance in the ground-floors of the keeper's house according to the drawings, and with timbers of the following scantlings:—

Joists	9×2¼
Trimming ditto	9×3
Plates on cross-walls	4×4
Wall plates as last described	6 4

Provide and lay two tier of bond 4 inches by 2½ inches all round the rooms of the ground story in the keeper's house, exclusive of wood bricks required to fix the skirting, windows, &c.

Frame and fix the roofs of the prisoners' privies in the airing courts with rafters 4 inches by 2 inches, rising plates 4 inches by 2½ inches, and pitching pieces 3 inches by 2 inches. Cover the same with inch deal battens 2¼ inches wide, laid to a gauge for countess slating, with proper featheredge eaves boards, and tilting fillets, 3 inches wide. Provide and fix wrought and rounded kirb 4 inches by 3 inches, on the top the stone pieces as shown in the drawing.

Frame and fix the roof over the wash-house and laundry according to the drawings, with timbers of the following scantlings:—

Hips rounded for lead	8×2
Common rafters as before described	3×2
Purlins	5×4
Pole plate with blockings	4×3
Wall plates as before described	5×4
Angle tyes and dragon pieces	4×4
Principal rafters	6×6
Tye beam	10×8
King posts	6×6
Struts	4×3

Provide and fix wrought-iron straps with bolts, &c. to feet of principal rafters and bottom of king, as shown on drawing. Cover the roof with inch deal battens 2¼ inches wide, laid to a gauge for countess slating, with proper featheredge eaves boards, and three quarter inch tilting fillets, 3 inches wide for slaters, and inch deal gutters and bearers adjoining the chimney shaft.

Frame and fix a quarter partition in the laundry enclosing staircase, with heads and sills 4 inches by 3 inches, door-posts and principal quarters 4 inches by 3½ inches, braces 4 inches by 2½ inches, and common quarters 4 inches by 2 inches.

Frame and fix a floor of joists to the laundry, according to drawings, and with timbers as follow:—

Joists	7×2¼
Trimming ditto	7×3
Binder chase-mortised for joists	12×6
Wall plate halved and spiked at the angle and to tail, &c. as before described	6×4
Plate on partition wall	4×4

Provide and lay one tier of bond 4 inches by 2½ inches in each of the stories of the last named building, where will be directed, exclusive of woodbricks required for fixing the windows, &c.

Frame and fix the open front and roof of the wheel-wings according to the drawings, and with timbers of the following scantlings:—

Round ridge	8×2
Common rafters with feet	

notched and tailed on wall plates and front plate, &c.	3×2
Principal rafters and braces forming five trusses to each of the mill-wings, dovetailed, and pinned together—the rafters to be notched and tailed on wall plate and front plate	5×3
Purlins	3½×3
Wall plate as before described	5×4
Front plate or bressummer wrought all round and mortised for posts, and firmly secured to wall plate	8×8
Posts under ditto, wrought all round with tenons in bressummer and stone plinth	8×6

Cover the roofs last described with inch deal battens 2¼ inches wide, laid to a gauge for countess slating, with proper featheredge eaves boards, and three quarter inch tilting fillets, 3 inches wide for slaters.

Provide for one tier of bond 4 inches by 2¼ inches, laid complete round the walls of each of the mill-wings.

Frame and fix the roof of the mill-house according to the drawings, and with timbers of the following scantlings:—

Rounded hips	8×2
Common rafters	3×2
Purlins	5×4
Pole plate with blockings	3×3
Wall plates as before described	5×4
Struts to purlins from truss where necessary	4×3
Principal rafters	6×6
Tye beam	10×6
King post	6×6
Braces or struts	4×3

Cover the roof last described with inch deal battens 2¼ inches wide, laid to a guage for countess slating; with proper featheredge eaves boards, and three quarter inch tilting fillets, 3 inches wide for slater.

Frame and fix floors of joists to the two stories of the mill-house, according to the drawings, with a well hole trimmed to each for a ladder, the whole of the timbers, and the front of the plates and bond to be planed; the timbers of the following scantlings:—

Joists framed to girders	5×2¼
Girders chase-mortised for joists	14×8
Templates to ditto, with fronts planed	5×4
Wall plates as before described	5×4

Provide for one tier of bond 4 inches by 2¼ inches, laid complete in each of the three stories of the mill-house before described, exclusive of wood bricks which may be required for fixing the windows, doors, &c.

All the joists throughout the different buildings are to be notched down 1 inch upon the plates, and to be spiked thereto. All the door-cases are to have tenons, and to be let into the stone steps or paving. All the iron straps or other iron-work necessary to fix the framing of the pews in the chapel, or divisions in the court, or other work throughout the different buildings required to be securely fixed, must be secured and screwed to the floor of joists and carcass timbers, independent of the floors.

Prepare and hang 3-inch six panel folding doors to the entrance under the portico, moulded and bead flush, with extra wide styles and rails, and double-margined centre stile, the upper panels fixed, the doors hung with two pair of weighty forked hinges, with proper screw-bolts and nuts, the whole according to the drawings at large. Provide for the necessary wood bricks to fix the upper part of the doors. Provide and fix a lock, bolts, and other fastenings of the value of two pounds ten shillings, as will be hereafter directed by the architect.

Prepare and hang 1½-inch deal, four panel, bead, flush, and square doors, leading from the entrance passage to the spectators' seats, hung with 3-inch wrought butts, and a 9-inch drawback lock to each, with 1¼-inch wrought and rebated jaumb lining and soffit to the same. Prepare and fix inch deal square skirting, 8½ inches high round the entrance passage leading to spectators' seats.

Prepare and fix deal cased frames, oak sunk sills, with 2-inch deal astragal and hollow sashes, single hung, with 2-inch brass axle pulleys, patent lines, iron weights, and sash fastenings. Provide and fix pulleys, and patent lines, to open top sashes, with hooks to same. Prepare and fix 1¼-inch deal wrought and splayed window board, with proper bearers to the windows of the court room. Prepare and hang 2-inch three panel wainscot, moulded both sides; folding doors leading to the passages in the court, with 6-inch three quarter inch, half rebated two bolt mortised locks, and plain furniture; two pair of 3-inch wrought butts, one 9-inch, and one 18-inch barrel, bolts to each; with 1¼-inch wainscot, keyed and double rebated, jaumbs and soffit properly backed; three quarter inch wainscot, wrought and beaded grounds, and moulded architrave one side, and wainscot staff bead the other side. Prepare 2-inch six panel wainscot moulded both sides: doors leading to magistrates' bench, and jury boxes, with jaumbs, and soffit, and moulded architrave, and staff bead, as last described, but not folding; with 6-inch three bolt mortise locks, and 3-inch wrought butts. Prepare and lay 1¼-inch yellow deal wrought, ploughed, and tongued floor, and inch deal wrought steps, risers, and proper bearers, in court room, where shown on the drawings. Prepare and fix 2-inch wainscot, one panel high, bead, flush, and square framing, in front of magistrates' bench, part circular on plan. The remainder of the partitions in front of spectators' seats, and forming the divisions in the court, to be of 1¼-inch wainscot, one panel high, bead, flush, and square framing; the doors hung with 2½-inch projecting butts, and a brass pulpit latch to each; the whole of the framing to be firmly secured by iron knee straps to the joists under the floor, the said straps to be provided and fixed by the carpenter. Prepare and fix 1½-inch wainscot, chamfered and groved capping to partition in front of magistrates' bench, 3 inches wide, and ditto, 2½ inches wide to the remaining partitions in the courts. The capping to be firmly screwed to the framing, and the whole of the screws in the capping and the wainscot framing, before described, to be countersunk, and carefully covered with wainscot. Prepare and fix 1½-inch deal wrought and cut bearers, and 1¼-inch wrought and rounded seats, from 12 to 14 inches wide, with groves stopped short, the flaps rebated, and hung with hinges. Inch wrought rounded, and splayed book-board, 10 inches wide, with wrought, splayed, and cut brackets, where shown on drawings. Prepare and fix 2-inch deal ploughed, feather-tongued, and blocked, cut circular, and edges rounded, for top of counsel's table, with wrought all round, framed and splayed top rail, 4¼ inches by 3 inches ditto, bearers 5 inches by 2 inches ditto, bottom rail 3 inches by 2 inches ditto, legs 3 inches square, let into the floor, and firmly secured to the joists; the whole of the seats, book-board, counsel's table, &c. to be rounded at the ends, and the whole of the fittings in the court to be in every respect as shown or described upon the drawings. Prepare and fix a desk for the chairman, with 1¼-inch ploughed, tongued, and rounded top, with a dovetailed wainscot drawer and frame, the drawer 16 inches by 12 inches, and 3 inches deep, with a good lock and key, and two drawer knobs.

Prepare and fix inch wainscot, keyed and feather-tongued wall lining, with upright beads, as shown in the drawings, to the wall all round the court, excepting the space occupied by the passage leading to the spectators' seats, with a wainscot groved bead, 1¼ inch thick, and 3 inches wide, as a capping to the same.

Prepare and fix 1¼-inch deal, wrought and splayed, capping top of plaster, impost moulding, forming the top fillet of the same, securely fixed to the chain plate. Prepare and fix three-quarter inch ploughed and tongued and beaded boarding to the court side of the partition, enclosing the passage leading to the spectators' seats.

Prepare and hang 2-inch deal six panel bead, flush, and square doors to lobbies of side entrances leading to officers' apartments, adjoining the court, hung with 3-inch wrought butts, a strong drawback lock, a 9-inch and an 18-inch bright barrel bolts to each.

Frame and fix proper doorcases, 4 inches square, to the same.

Prepare and lay 1¼-inch yellow deal straight joint floors, with borders to slabs, in the magistrate's grand jury, and counsel's rooms; and inch yellow deal straight joint floors, with border to slabs, to the remaining rooms and passages of the wings adjoining the court, excepting the spaces shown or described to be paved with stone.

Prepare and lay inch steps, risers, and proper bearers, leading to magistrates' bench.

Prepare and fix three quarter inch wrought and framed grounds, 2¼ inches wide, with torus skirting, 8½ inches high, to the aforesaid wings, excepting the magistrates', counsel's, and grand jury rooms, and passages adjoining, which are to have inch wrought and framed grounds, 2¼ inches wide, and inch wrought, rebated, and blacked plinth, 8¼ inches high, with base moulding, 3 inches girt, on same. The sides of the magistrates' room to be lined with three-quarter inch battening, 2¼ inches wide, for lathing; the battens, 1 foot from centre to centre, securely fixed with wall hooks where necessary. Prepare and fix deal-cased sash frames, oak sunk sills, 1¾-inches ovolo sashes, double hung with patent lines, brass pulleys, patent sash fastenings, and iron weights complete, and inch wrought linings and soffits, with ogee round same to all the windows of the wings before described. The four windows to the counsel's and petty jury, and clerks' rooms, in front of the building, are to have 1¼-inch four panel moulded, and square shutters; and inch deal four panel square back flaps hung with hinges, and with proper boxings, inside lining, and ogee architrave, with a strong iron shutter bar, and two brass shutter knobs to each. Prepare and hang 1½-inch deal ovolo moulded and square doors, hung with 2½-inch wrought butts, and 6-inch iron rim three bolt locks, with brass knobs; and inch rebated and beaded linings and soffits, with an ogee architrave on one side to all the rooms of the wings before described, excepting the magistrates' and grand jury rooms, which are to have 2-inch deal four panel doors, moulded both sides, hung with 3-inch wrought butts, 6-inch three bolt mortise locks, and plain brass furniture; 1¼ double rebated linings and soffit, inch wrought framed and beaded grounds, with a moulded architrave on one side. The doorway in the passage leading to magistrates' bench, and adjoining grand jury room, is to have a 2-inch four panel door, moulded both sides, hung with 3-inch butts, a 6-inch iron rim, three bolt lock, and 1¼-inch rebated, and double beaded jaumb linings and soffit. Prepare and fix proper deal square angle staff beads to the chimney breasts of the magistrates' and grand jury rooms. The external doors to the magistrates' room, and passage leading to privies, to have 2-inch deal four panel moulded and bead flush doors, hung with 3-inch wrought butts, with a strong drawback lock, a 9-inch and an 18 inch bright barrel bolt to each; frame and fix proper door-cases 4 inches square to the same.

Prepare and fix deal cased frames, oak sunk sills, 1½-inch deal ovolo sashes, single hung with lines, iron pulleys and weights and sash fastenings complete, and inch wrought and beaded linings and soffits, and 1¼-inch rounded window boards and bearers to the infirmaries and rooms adjoining, and two wrought ventilators to the ceiling in each of the infirmaries. Prepare and lay inch yellow deal folding floors to the rooms last described, and passages adjoining, with borders to slabs. Prepare and fix inch square skirting, 8½ inches high, to the rooms and passages last described.

Prepare and hang 1½-inch deal, bead, flush, and square doors, hung with 2½-inch wrought iron butts, 6-inch iron rim three bolt locks, with brass knobs, and inch wrought rebated and rounded linings and soffits to the small rooms, and 2-inch deal, bead, flush, and square doors, hung with 3-inch wrought iron butts, and strong drawback locks, with brass knobs, a strong 18-inch bolt, and 1¼-inch deal wrought, rebated, and rounded linings and soffit to the infirmaries.

Prepare and fix deal cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung with lines, iron pulleys and weights, and sash fastenings complete, and inch deal wrought and beaded linings and soffit, with 1¼-inch window board and bearers to the receiving and fumigating room, lock up room, bath room, surgery, and staircases. Prepare and hang 2-inch four panel, bead, flush, and square external doors to receiving and fumigating room, bath room, and staircases, with 3-inch wrought butts, a strong drawback lock, a 9-inch, and an 18-inch bright barrel bolts to each. Frame and fix proper door-cases, 4-inches square, to the same. Prepare and hang 1½-inch four panel, bead, flush, square doors to the four openings of lock-up room, surgery, and passage adjoining, as shown on plan, hung with 2½-inch wrought butts, with locks and bolts, and fastenings, as last described, with inch deal wrought, rebated, and rounded linings to the same.

Prepare and fix a closet in the surgery, 4 feet wide, and 18 inches deep, the whole height of the room, with inch deal framed and beaded front and side, and inch deal four panel square door, hung with hinges, and a good brass cupboard lock; 3-inch deal wrought shelves and bearers to be provided and fixed in the same, with a dwarf door, shelf and bottom, and brass button in the upper part. Prepare and hang a 2-inch deal four panel bead flush and square door, dividing the two staircases adjoining, hung with 3-inch wrought butts, and a lock, as last described, with 1¼-inch deal, wrought, rebated, and rounded jaumb lining and soffit.

Prepare and hang 1¼-inch deal wrought, ploughed, tongued, and ledged doors, leading from yards of receiving and bath rooms, with cross garnets, and 10-inch stock lock, and proper door-cases, 4 inches by 3 inches to each. Prepare and hang two three-quarter inch deal, wrought, ploughed, tongued, and ledged doors to coal vaults, under the last-named rooms, and one ditto to the coal-hole adjoining counsel's privy, with cross garnets, padlock, hasp, and staple to each.

Prepare and hang inch, ploughed, wrought, tongued, and ledged doors, with a hole cut in each; 16-inch cross garnets and a thumb-latch and catch to each of the privies in the yard, adjoining the receiving and bath rooms.

Prepare and fix proper door-cases 4-inches by 2½-inches, and inch deal rounded seat and riser, with proper bearer, and hole cut and rounded to the same.

Prepare and hang ledged door and frame with fastenings and seat-riser and bearers, as last described, to the privy adjoining the counsel's room. Prepare and fix deal-cased frame oak sunk sills, 1½-inch ovolo sashes, single hung, with pulleys, lines, weights, and sash fastenings complete, and inch deal wrought and beaded linings and soffit, and 1¼-inch deal wrought and rounded window board and bearers; and prepare and hang 1½-inch deal, four panel, bead, flush, and square door, with 2½-inch wrought butts, with 6-inch iron rim, three bolt lock; and prepare and fix proper door-case, 4 inches by 3 inches, to the store-room adjoining prisoners' entrance. Prepare and fix three quarter inch deal square skirting, 4¼ inches high in ditto.

Prepare and hang 3-inch deal, six panel, bead, flush, and square doors, to prisoners' entrance in front, as also to entrance at back of prisons, with deal trunnels, circular head, and extra wide styles and rails, hung with strong forked hinges, the carriages of which are to be securely let into the walls, the whole to be provided and fixed, or hung, by the carpenter, in the manner shown or described upon the drawings. The locks and other fastenings to this gate (excepting the hinges before described) will be provided by the smith, but the carpenter is to assist in fixing the same. Prepare and hang 2-inch deal six panel, bead, flush, and square door, adjoining the last at the front entrance for prisoners, with an inspection hole, to be provided by the smith, but fixed by the carpenter; 4-inch wrought butts, a strong drawback lock, and other fastenings, which may be directed, to the value of three guineas.

Prepare and fix a proper door-case, 4-inches square, to the same.

Prepare and fix deal-cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung with lines, iron pulleys, and weights, and sash fastenings complete, and inch deal wrought and beaded linings and soffit, and 1¼-inch deal wrought and rounded window board and bearers to keeper's lodge and bed-room.

Prepare and fix three-quarter inch deal square skirting, 6 inches high in ditto, and prepare and lay inch yellow deal wrought folding floor to the bed-room. Prepare and hang 1½-inch deal four panel, bead, flush, and square door to keeper's lodge, with 2½-inch wrought butts, a drawback lock, and two 9-inch bolts. Prepare and fix a proper door-case, 4 inches by 2½ inches to the same.

Prepare and hang 1¼-inch, four panel, square, internal doors of wash-house and bed-room, with 2½-inch wrought butts, and a 6-inch, three bolt, iron-rim, lock, and inch deal wrought rebated and double-beaded jaumbs, and soffit to each. Prepare and hang 1½-inch deal ovolo, sunk door to wash-house, bead, flush, and square bottom, with 2½-inch butts, and a 6-inch, iron-rim, two bolt lock, with brass knobs.

Prepare and fix a proper door-case, 4 inches by 2½ inches for the same. Prepare and hang ledged door and frame to the privy, with fastenings, seat-riser, and bearers, as before described for the privies.

Prepare and fix deal-cased frame, oak sunk sill, 1½-inch ovolo sashes, single hung with lines, iron pulleys and weights, and sash-fastenings complete, with ogee moulding round same, in magistrates' privy. Prepare and hang 1¼-inch deal four panel, bead, flush, and square door, with 2½-inch wrought butts, a thumb-latch, and a small brass bolt.

Prepare and fix a proper door-case, 4 inches by 2½ inches to the same. Prepare and fix inch deal wrought and rounded seat-riser, with proper bearers, and a hole cut and rounded in the seat. Inch square skirting in ditto.

Prepare and hang 1½-inch ovolo folding sashes to stable, with 2-inch butts, a brass button, and two small bolts with solid wrought, framed, rebated, and beaded frame, 4 inches by 2½ inches, oak wrought, framed, rebated, and weathered sill, 1¼-inch deal window-board, and proper bearers. Prepare and hang 1¼-inch wrought, ploughed, tongued, beaded, and ledged door, with cross garnets, a sunk stable latch, and a 10-inch stock lock with two keys.

Prepare and fix a wrought proper doorcase, 4 inches by 3 inches for the same. Prepare and fix a stall-post, 6 inches by 5 inches, wrought and framed into an oak sleeper, and the ceiling binder before described.

Prepare and fix a wrought and framed oak bottom rail, 4½ inches by 4 inches. Fir wrought and framed middle rail 4 inches by 3 inches, and top rail wrought, framed, and rounded, 4 inches by 3 inches. Prepare and fix 1½-inch deal, wrought, ploughed, tongued, and beaded boarding, let into a groove made into the rails and posts for the same. Prepare and fix a wrought, framed, and cut-post at end of partition, to support manger, and grooved to receive the boarding last described. Prepare and fix wrought, splayed, and rebated front, and bottom of manger with wrought, splayed, and rounded nosing.

Provide for all proper and sufficient wrought and framed struts, bearers, and templates under the manger.

Prepare and fix three-quarter inch deal, wrought, ploughed, tongued, and beaded boarding over manger at back and against side-wall of stalls, and assist the smith in fixing the iron rack. Provide and fix two manger-rings to each of the stalls, with lines and weights. Provide for four rings to posts and wall, and also two harness pegs to each of the posts.

Prepare and fix 1¼-inch deal, wrought and chamfered rail, 4½ inches wide, and 5 feet long, with four wrought dovetailed and cut-harness brackets, 10 inches projection, and inch wrought and splayed rail, 3 inches wide and 4 feet long, with nine framed and turned pegs, 6 inches projection, to be fixed where will be directed. Provide also for a corn-bin, 5 feet by 3 feet, and 3 feet 6 inches high, with inch round sides and top with tongued joints, and two flaps hung with 12-inch cross garnets, and a padlock, hasp, and staple to each; two divisions are to be formed under the flaps, the whole of the outside is to have proper framed and skeleton grounds or bearers, to receive the sides, top, &c. before described, and to be fixed where will be directed by the architect, or his clerk of the works. Prepare and fix also 2-inch wrought shelves in the stable, 5 feet long and 8½ inches wide, with brackets, where will be directed. Provide and fix inch deal rough front, with skeleton grounds for hay in the angle of stable, as shown on plan. Provide and fix wheel-boards, 8½ inches wide at each side of the chaise-house.

Prepare and fix deal-cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung with lines, iron pulleys and weights and sash fastenings complete, to the dead-house. Prepare and frame a deal table about 8 feet by 4 feet, and 3 feet high, with proper, strong, and sufficient wrought and framed legs, rails, &c.

Prepare and hang inch wrought, ploughed, tongued, beaded, and ledged doors to the doorways of the dead-house, and hay and straw room, with cross garnets and a stock-lock to each. Prepare and fix wrought proper door-cases to the same, 4 inches by 2½ inches.

Provide and lay 1¼-inch yellow deal folding floor to the chapel-passage, &c. with risers as shown in the drawings, and three-quarter inch square skirting, 4¼ inches wide top of same where there are no partitions. Prepare and fix inch deal wrought, rebated, and beaded linings, and inch deal wrought, ploughed, tongued, and ledged trap, hung with hinges, and a 6-inch neck bolt, to the ceiling of the staircases, leading to the infirmary; also to the ceiling of the chapel.

Prepare and hang 1¼-inch deal wrought, ploughed, tongued, and ledged door to each of the prisoners' staircases leading to the roof, with cross garnets and a 6-inch iron-rim lock, to each of the said three doors, to have wrought proper door-cases, 4 inches by 2½ inches. Provide a wrought and framed ladder for the same, with 1¼-inch steps, and 1¼-inch sides, with hooks in wall for the same, where will be directed. Prepare and fix deal-cased frames, oak sunk sills, and 2-inch deal ovolo sashes, single hung, with lines, iron pulleys and weights, and sash fastenings to the windows of the chapel, with inch wrought and rounded linings and soffit, and 1¼-inch wrought and rounded window board and bearers. Provide also patent lines, pulleys, and hooks to each of the chapel windows, to open same. Prepare and fix 1½-inch square framing and doors, two panels high, with 2½-inch projecting butts, and brass pulpit latches to reading and clerk's desks, pulpit, and pews adjoining; the whole of the framing to be firmly secured by iron knee-straps to the joists under the floor, and an iron stud fixed to the hanging style of each door, the said straps and studs to be provided and fixed by the carpenter.

Prepare and fix 1½-inch wrought chamfered and grooved capping according to drawing, over the framing last described, and securely screwed to the same. The carpenter is to assist the smith in fixing the iron rails and spikes over the partitions of debtors' and female prisoners' pew. Prepare and fix proper book and kneeling boards, and three stools for pulpit, reading and clerk's desks.

Prepare and fix a pair of moveable steps to keeper's pew in the chapel, with 1¼-inch wrought and rounded treads, 8 inches wide, and 1½-inch wrought sides, 9 inches wide, grooved for treads; the whole to be framed together, and to be made to let down into the chapel, and hung with butt hinges. Prepare and fix four large ventilators in ceiling of chapel, upon the same principle as those before described for the hospital.

Prepare and fix 1½-inch wrought and rounded seats and bearers to debtors' and female prisoners' pews, with flaps hung with hinges where shown on the drawings; 1½-inch wrought and rounded seats with bearers, for the remainder of the prisoners. Prepare and fix 2-inch flush-framed partitions dividing prisoners' seats, with a strong capping to the same; the whole secured to the open railing and floor, and to the wall, by iron tyes with screws, which are to be provided and fixed by the carpenter. The carpenter is also to assist the smith in fixing the iron rails and spikes over the said partitions. Prepare and hang 1¼-inch four panel square doors to the partition enclosing staircase, hung with 2½-inch wrought butts, and 6-inch three-bolt iron-rim locks, with brass knobs, and inch wrought rebated and double-beaded jaumb linings and soffits to each. Prepare and fix inch yellow deal steps risers, with rounded nosings and proper carriages, from the keeper's rooms to the chapel; with 1½-inch wrought, framed, and beaded stringboard, three-quarter inch deal square skirting cut to steps, 2½-inch deal square-framed newels, and inch deal square bar balusters and deal moulded hand-rail.

Prepare and lay inch yellow deal wrought straight joint floor, with borders to slabs, and three-quarter inch deal square skirting, 6 inches high, to the rooms and passages of the one-pair story in the keeper's house. Prepare and fix deal-cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung, with lines, iron pulleys and weights, and sash fastenings; inch deal wrought and rounded linings and soffits, and 1¼-inch deal wrought and rounded window board and bearers to the front and back rooms and back windows of prisoners' stairs.

Prepare and hang 1¼-inch four panel square doors to the front and back rooms, with 2½ inch wrought butts, a 6-inch iron rim three bolt lock, with brass knobs and inch wrought rebated and double-beaded jaumb linings and soffit to each.

Prepare and lay 1¼-inch yellow deal wrought straight joint floor, with borders to slabs, to the front rooms and entrance on the ground floor of the keeper's house. Prepare and fix three-quarter inch deal square skirting, 8½ inches high, all round the rooms, passages, entrance, and staircase. Prepare and fix deal-cased frames, oak sunk sills, 1½-inch deal ovolo sashes, double hung, with lines, iron pulleys and weights, and sash fastenings complete, to the windows of the front and back rooms and entrance, with inch deal wrought and rounded linings and soffits, and 1¼-inch deal wrought and rounded window boards and bearers.

Prepare and hang six 1½-inch deal bead and flush and square doors to the front and back rooms, with 2½-inch wrought butts, a 6-inch iron rim three bolt lock, with brass knobs, and inch deal wrought rebated and double-beaded jaumb linings and soffit to each. Prepare and hang 2-inch deal six panel bead flush and square door to entrance, with 3-inch wrought butts, an 8-inch drawback lock with brass knobs, and one 9-inch and one 18-inch bright barrel bolts. Prepare and fix a proper door-case, 5 inches by 4 inches, to the same, and inch wrought and beaded jaumb linings and soffit.

Prepare and hang 1¼-inch deal wrought, ploughed, tongued, beaded, and ledged doors to prisoners' staircases and day rooms, leading to airing courts, with cross garnets, an 8-inch drawback lock, with brass knob, and such other fastenings as shall hereafter be described. Prepare and fix proper door-cases, 5 inches by 4 inches, to the same. Prepare and fix deal-cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung, with lines, iron pulleys and weights, and sash fastenings to the window adjoining the staircase doors last described. Prepare and fix inch deal wrought and rounded linings and soffit, and 1¼-inch deal wrought and rounded window-boards to the same.

Prepare and fix four deal-cased frames, oak sunk sills, and 1½-inch ovolo sashes, single hung, with lines, iron pulleys and weights, and sash-fastenings, inch linings and soffit, and 1¼-inch window board and bearers in the basement under the keeper's house. Prepare and hang inch deal, proper ledged doors, with cross garnets, and a 6-inch iron-rim lock to each of the rooms in the basement. Prepare and fix proper door-cases, 4 inches by 2½ inches, to the same.

Prepare and fix fir solid wrought rebated frames and sunk sills to all the day rooms and passages in the prisoners', turnkeys', and servants' rooms, and windows of prisoners' staircases, with 1½-inch deal ovolo sashes, hung with 2-inch butts and fastenings to each, as per drawing.

Prepare and fix fir solid wrought and rebated frames and sunk sills for iron shutters, where described, for the cells of the prison.

Prepare and hang 1¼-inch deal wrought, ploughed, tongued, and ledged doors between the two airing courts opposite to the mill-wheels, with strong cross garnets, and an 8-inch drawback lock with brass knob; fir wrought proper door-cases, 4 inches by 3 inches, to the same.

Prepare and fix three wrought and framed deal pump-cases, with 2-inch sides, &c. complete, in the court-yards, where described on the drawings, as will be directed by the architect, or his clerk of the works.

Prepare and fix wrought, chamfered, and framed skeleton-bearers, rails, and styles to two cisterns in prisoners' airing courts, bottom bearers 8 inches by 6 inches, and the remaining rails, &c. 6 inches square; the sides to be lined with inch deal, wrought both sides, ploughed, tongued, and beaded boarding; the bottom 1¼-inch deal ditto. Rebate the top rails for, and prepare and fix inch wrought both sides, ploughed, tongued, and ledged flaps. The whole of the aforesaid cisterns to be in every respect according to the drawings, and to be fixed in the prisoners' airing courts as shown on the drawings.

Prepare and fix deal-cased frames, oak sunk sills, 1½-inch ovolo sashes, single hung, with lines, iron pulleys, and weights, and such fastenings complete, and inch wrought and rounded linings, and 1¼-inch wrought and rounded window-boards and bearers to the windows of laundry, and 1½-inch deal wrought ironing-board, about 8 feet long and 3 feet wide, with proper bearers to same. Prepare and lay inch yellow deal wrought folding floor, and three-quarter inch square skirting, 4¼ inches high, to the same. Prepare and hang 1¼-inch four panel square door to top of stairs, with 2½-inch butts, and a 6-inch two-bolt iron-rim lock, and inch rebated and rounded linings to the same. Prepare and fix window-frames, sashes, linings, and window-boards, and skirting to wash-house, as described for the laundry. Prepare and fix three-quarter inch wrought, ploughed, tongued, and beaded enclosure to closet and stairs, with proper grounds or bearers for the same. Prepare and hang three-quarter inch wrought, ploughed, tongued, beaded, and ledged door to ditto, with cross garnets, a lock, and thumb latch, and a proper door-case, 3 inches by 2½ inches, to the same.

Prepare and hang 1¼-inch wrought, ploughed, tongued, beaded, and ledged external doors to entrance of wash-house, and stairs leading to laundry, with cross garnets, and 8-inch drawback lock, and two 9-inch rough bolts to each. Prepare and fix proper door-cases, 4 inches by 2½ inches, to the same. Prepare and fix deal-cased frames, oak sunk sills, 1½-inch deal ovolo sashes, single hung, with lines, iron pulleys and weights, sash-fastenings, with inch deal, wrought and rounded linings, and 1¼-inch deal wrought and rounded window-board and bearers to the window-openings in the three stories of the mill-house. Prepare and hang 1¼-inch deal wrought, ploughed, tongued, beaded, and ledged door to lower story, hung with cross garnets, and an 8-inch drawback lock.

Prepare and fix proper wrought door-cases, 4 inches by 2½ inches, to the same.

Prepare and lay 1¼-inch yellow deal folding floors, wrought both sides with wrought, ledged flaps, and iron rings to well-holes, and three-quarter inch deal square skirting, 4¼ inches high, to the first and second stories of the mill-house. Prepare wrought and framed ladders to the ground and one-pair stories, with 1½-inch deal sides, 9 inches wide, and 1¼ inch deal treads, 8 inches wide.

All the ironmongery and smith's work described or required for the carpenter's and joiner's work, is to be provided by the carpenter. All the butt and other hinges are to be of well hammered wrought iron. It is to be observed in respect to the locks throughout the buildings, that a master-key, or key to pass, must be provided by the carpenter, where required by the magistrates.

All the fir is to be of the best Memel, or other timber equally approved by the architect, to be sawn die square, and free from sap or shakes. The oak is to be of English growth, of the best quality, and of trees that have been cut down at least two years from the time of signing the contract; to be sawn die square, and free from sap or shakes. The deals to be of the best yellow Christiana, or other deals equally approved by the architect, and free from sap or large or loose knots.

Mason. The stone to be used for the masonry throughout the different buildings, is to be from excepting those parts which are otherwise described.

Provide and set 4-inch Yorkshire landings under the footings of the brickwork under the columns and pilasters of the portico, in lengths of 4 feet each. Provide and set Yorkshire springing-stones under the columns and pilasters, with top beds rubbed, and skewbacks worked for the inverted arches, as shown upon the drawings.

Provide and set rubbed Yorkshire steps, of the best quality, to the portico; also to the two side entrance doorways, of the sizes and dimensions figured, and in the manner shown upon the drawings; each stone to be secured together by stone plugs, 4 inches long and 2 inches square. Rubbed Yorkshire paving, in regular courses, under the portico, not less than 3 inches thick, nor less than 6 superficial feet in size; the whole to be well set in mortar upon the sleeper walls, and the joints pointed with cement. The steps and paving last described are to have a rubbed circular sunk edge, well fitted to the columns, and notched where required.

The shafts of the columns are to be carried up with in seven stones, including the capitals, as shown in the drawings; the joints to be rubbed, and to have stone joggles, 8 inches long, and 4 inches square, let in, and bedded in cement, with milled lead, four pounds to the foot superficial, between each joint, and within 1 inch of the flutes all round; the remaining space of 1 inch to be filled up with a composition of stone-dust, rosin, and bees'-wax; the shafts to be fluted after they are fixed, and the caps moulded, and to be in every respect according to the drawings. Iron joggles, 8 inches long, and 2 inches square, are to be provided by the mason, and let in and run with lead over the capitals of the columns and pilasters.

The pilaster-caps and those stones below, indicated by the joints shown in drawings, to be in single stones, worked in every respect as shown in the drawings, with an iron joggle as last described let in and run with lead at the top of each.

The architrave over the columns and pilasters, including the band or fillet, are to be of stone, in single pieces, between the centre of each of the columns and pilasters, and to extend within 9 inches of the internal face of the court-room wall, to be worked in every respect according to the drawings, with rubbed joints, and large double plugs run with lead near the soffit, and dovetailed iron cramps at the top, the angle-joints to be sunk and rubbed at the mitres so as to meet at the internal angle of the portico, and to have stone dovetailed joggles and plugged, according to drawing.

The internal part of the architrave is to be rough, sunk above the fillet to receive the stucco, an iron chain-bar to be provided by the mason, and to be let into and run with lead at the top of the architrave, extending to the internal part of the court-wall, with calkings to the same, an iron ring is to be let in at the angles of the portico to receive the calkings provided in the chain-bar.

The frieze to be also of stone, 9 inches thick, exclusive of the projections for triglyphs, worked in every respect according to the drawings, with concealed sunk joints, and lead plugs to each. The external angle-stones to be in solid blocks, and to bed the full width of the triglyphs. Iron plugs are to be provided by the mason, and let into the architrave and cornice, not more than 3 feet apart, where will be directed.

The cornice and pediment is to be of the sizes marked or figured, and worked in every respect according to the drawings, with dovetailed stone joggles, 8 inches long and 4 inches square, let in flush, and the joints grooved and run with lead.

The springing and saddle-stones to be in solid blocks, as indicated by the joints marked upon the drawings; and each stone of the raking-cornice and upper part of the cornice at the side to be secured to the stone below by iron plugs (to be provided by the mason) run with lead, and to have two strong 12-inch iron cramps, 1 inch wide and 2½ inches thick, with calkings let into top, and well run and covered with lead.

The tympanum of the pediment to be 5 inches thick, rubbed, with bond-stones, the whole properly cramped.

The front under portico, and the inside and outside returns adjoining the pilasters, are to be 6 inches thick, rubbed, and the pilaster-shafts 9 inches thick, (excepting the solid stones at the top before described,) and of the sizes indicated, and in every respect according to the drawing, and the whole properly cramped, the pilaster-shafts to be plugged with lead at every joint.

The remaining part of the architrave inside of the portico to be rubbed, 8 inches thick, of the size indicated, and in every respect as shown upon the drawings, the whole properly cramped, and to be plugged with lead at every joint.

Provide for sufficient bond-stones behind the tympanum of the pediment, the frieze of the entablature, and the ashlering to the inside of the portico, architrave, &c. before described, to be composed of 6-inch York landing, secured to the same by iron cramps 12 inches long, in cement. The courses of ashler which come over openings, and in all other cases where necessary, to have concealed arch-joints.

The cornice of the portico to continue round the wings and returns adjoining to bed, the full width of the wall, and to be worked and set in the manner shown on the drawings, with all proper and sufficient cramps and lead plugs well run and covered with lead, stone blocking course over same, with joints plugged and strong 12-inch cramps, well run and covered with lead, and in every respect as shown upon drawings.

The impost moulding adjoining the portico to be in two heights, to bed 9 inches in the wall, and be plugged with lead and cramped at every joint, the whole to be worked and set according to the drawings.

The architrave round the front-entrance door under the portico, and the side-entrances adjoining, to be of the sizes and in the manner shown upon the drawings, with all proper and sufficient bond-stones, cramps, and plugs, run with lead. Larger stones to be provided and set for the forked hinges to the entrance-door under the portico, which are to be carefully let in and run with lead by the mason, who is to assist the carpenter in hanging the doors.

The cornices and blocking courses over architraves, friezes, and cornices, and sills to windows of the magistrates' and grand-jury wings, with the returns, to be worked and set in every respect according to the drawings, with sunk duffils to the windows, and the whole to be securely plugged with lead, and to have iron cramps well run and covered with lead where necessary.

The cornices and blocking-courses over, and the rusticks to the doorways under the same in the prisoners' entrances, and blank one corresponding, to be worked and set in every respect according to the drawings; the rusticks and spaces between to be tool-stroked, and the whole to be securely plugged with lead, and to have iron cramps well run and covered with lead where thought necessary.

The plinth to the whole of the front-buildings, including the several returns, and prisoners' entrance-porch, and corresponding blank ditto, to be 6 inches thick, tool-stroked, weathered at top, and worked according to drawings, with proper bond-stones not less than 15 inches thick at every fourth stone, the whole to be plugged at every joint, and cramped where thought necessary.

Proper Yorkshire stones are to be provided, worked, and set for the hinges and bolts of the prisoners' entrance-gates, and iron gates to the same, and the stable-court, also for the wood gates to the entrance at the back of the prisons, including the key-stones for the top of bolts and circular wheel-stones, the whole well run with lead, and cramped where necessary. The mason is to assist the carpenter and smith in fixing the said gates, and to find all the requisite labour thereto.

Rough York stone blocks are to be provided, worked, and set for the iron hooks to hinges of the said gates, with iron rings, to be provided by the mason, and securely fixed to the same.

Plain Yorkshire chimney-pieces rubbed, cramped, and set with rubbed slabs and rough back-hearths to all the chimneys of the front and infirmary buildings, keeper's house and laundry, according to drawings; that to the grand-jury room to be of a better description, according to drawing, and that to the magistrates' room to be of polished dove marble, with polished dove marble slab, worked, cramped, and set according to drawing, and with a rubbed York back-hearth.

The whole of the coping to the front-buildings, including those over the back-wall of court, and over the arches of prisoners' open entrance-gates, and where shown on the drawings, to be rubbed, weathered, and throated according to drawings, or as shall be directed.

Provide and set 3-inch self faced Yorkshire landings over the cells, day rooms, and passages of the prisons in the upper story, in long lengths the whole width; the joints properly splayed as shown in the drawings, and set in cement, to lay 4½ inches upon the walls, and to be cut out where intercepted by the flues of their clear size, the spaces between the landings in the walls to be filled up with brickwork in cement; the landings to be cramped and tied where necessary.

Provide and set rubbed Yorkshire heads, and weathered and throated sills to the windows of cells, day rooms, passages, and prisoners' staircases throughout the upper story, rebated and worked of the sizes and dimensions shown upon the drawings. Rough tooled Yorkshire stone jaumbs and heads to be provided and set for all the iron doors to the cells and day rooms, rebated and worked of the sizes and dimensions shown upon the drawings; also stone heads to all the open iron gates in the passages, &c., as shown upon the drawings.

Provide and set 6-inch proper York stone sinks, with washers dished, at the end of the prisoners' passages, as shown upon the drawings.

Provide and set 5-inch self-faced York landings to the floors of the cells, day rooms, and passages adjoining, on the upper story of the prisons, the joints properly joggled and set in cement, to lay 4½ inches upon the walls, to be cut out where intercepted by the flues of their clear size, the space between the landings to be filled up with brickwork in cement, the landings to be cramped and tied where thought necessary, and to be in every respect as shown and described upon the drawings.

Provide and set rubbed Yorkshire heads, and weathered and throated sills to the windows of the cells, day rooms, passages, and prisoners' staircases, on the one pair story, as before described for the upper story. Provide and set rough tooled Yorkshire stone jaumbs and heads to all the iron doors on this story, as before described for the upper story; also stone heads to the open iron gates, as before described; also stone sinks at the end of the passages on this story, as before described for the upper story.

Provide and set 5-inch self-faced York landings to the floors of the cells, day rooms, and passages, on the one pair story of the prisons, as before described for the floors above. Provide and set rubbed Yorkshire heads, weathered and throated sills to the windows of the cells, day rooms, passages on the ground story, and to the different stories of the keeper's house, and where otherwise shown upon the drawings, and as before described for the upper story.

Provide and set rough tooled Yorkshire stone jaumbs and heads to all the iron doors, and heads to the open iron gates, including the one at the prisoners' passage leading to the court, and to the cell at the prisoners' entrance gate, on this story, as before described for the upper stories; also stone sinks at the ends of the passage, on this story, as before described for the upper stories. Provide and set also proper 5-inch York stone sinks, with washers dished, in the two kitchens of the keeper's house, prisoners' wash-house, and wash-house adjoining prisoners' entrance gate, also to each of the three pumps. York stone bearers under all the sinks before described.

Provide and lay self-faced York paving, with splayed joints set in cement and not less than 2½ inches in thickness, to all the cells, passages, and staircases of prisons on the ground floor, and all other internal parts throughout the different buildings, distinguished by a blue tint upon the plans. The external paving to the different courts, yards, &c., also distinguished by a blue tint upon the plans, are to be paved with Yorkshire paving, at least 2½ inches thick, laid to a proper current, and fitted to the iron gratings, &c., as will be directed.

Provide and set proper York steps, and 5-inch self-faced and joggled landings, securely let in at least 9 inches, and pinned to the walls of the prisoners' staircases, and all the staircases of the different buildings, excepting the wood stairs before described in the carpenter's work, and leading from the one pair story of the keeper's pulpit, &c. in the chapel. Provide also proper York steps to all the doorways throughout the different buildings, to the prisoners' stairs leading to courts, and also those leading to vaults and coal cellars, and where otherwise shown upon the drawings.

Twenty-four circular holes are to be worked and rebated, 12 inches in diameter, in the 5-inch York floors of the different stories in the prisons, with an iron grating in each, (to be provided by the mason,) and let in flush, and well run with lead.

Provide and set stone jaumbs and dressings, with projecting soffit and cantilivers, to the doorway of the keeper's house, according to drawing, the whole to be properly plugged, and cramps run with lead where necessary. Rubbed Yorkshire steps and pedestals in front of same.

Provide York riser and bottom, and York stone for trap to the privies in the prisoners' airing courts, as shown on the drawings.

Provide and set proper York throated sills to all the windows throughout the different buildings, except where otherwise described.

A York stone block is to be joggled and set securely into the walls of such of the cells in the different stories, as may be directed by the magistrates, and not to exceed thirty in number, 18 inches by 12, and of the whole thickness of the walls, with an iron ring 6 inches diameter, to be provided by the mason, and let in and run with lead, as will be directed by the architect, or his clerk of the works.

Provide and set proper York throated copings on the whole of the piers to the boundary walls, and where otherwise shown, and according to the sizes figured, and in the manner shown upon the drawings.

Provide and set six York stones in the walls of the wheel rooms, 3 feet 6 inches long, 14 inches wide, and 9 inches deep, as shown in the drawings.

Provide and set tooled kirbs for iron gratings to the areas in front of keeper's house, as shown in drawings.

All cramps, iron plugs, lead, and coals for cramping, &c., required for the masonry, are to be provided by the mason. It is also to be observed, in laying the York floors before described, for the cells, passages, &c., that no joint will be allowed at or within 3 inches of the hanging styles of the iron doors.

The contractor for the mason's work must provide for the security of his work from all damage, and repair all injury that it may sustain during the execution of the work, from whatever cause it may arise, so that it may be delivered up in a complete state when the building is finished.

The whole of the masonry, and all the beds, joints, faces, mouldings, and drips, to be worked in the best and most careful manner, and put together according to the directions of the architect, or his clerk of the works, with the required joggling, sinkings, and drips, to all projections and upper surfaces; the cornices, and all horizontal mouldings, projections, and blocking courses, are to be worked with water joints. The ashler to be in regular courses, the faces, joints, and beds, to be worked fair, each stone of which is to be cramped with strong copper cramps; and the bed of every ashler stone to be joggled into the stone below it with strong copper joggles, and cramped to bond-stones with strong copper cramps.

The whole of the masonry to be set in the best manner, and well bedded in fine mortar, and cramped together to bond-stones with strong iron cramps, (except where described to be of copper.)

All the iron cramps and chain bars to be well covered with rosin whilst hot.

The mason is also to cut the necessary grooves for iron-work, mortises for door-cases, holes for bars, balusters, iron guards, and every other description of iron or other work, which is described in the specification, or shown in the drawings, as being connected with the masonry.

All joints marked on the drawings are to be strictly adhered to, and no more to be made, unless ordered by the architect.

The contractor for the mason's work is to send a sample of the different qualities of stone intended to be used, to the architect, previous to their being worked in the buildings.

All the stone described as self-faced Yorkshire must have an even face, but need not be tooled.

Smith and Iron-founder. Provide and fix cast-iron railing, and iron kirb, enclosing the front court, with two pair of folding gates, and one side gate, with brass joint hinges, and brass warded locks and bolts of unexceptionable quality, each of the locks to be not less than twenty-one shillings value; the whole to be put together and run with lead where necessary, and cast and put up with the several ornaments, and in every respect according to the drawings.

Provide and fix cast-iron gratings to passage in court-room, to give light and ventilation to the prisoners' passage under; and two cast-iron ornamental ventilators, with wrought-iron straps, securely screwed to the woodwork, in the manner shown, and in every respect according to the drawings.

Provide and fix wrought-iron ornamental dwarf folding gates, as per drawing, enclosing the recesses at the prisoners' front entrance, and corresponding blank entrance; the said gates to have a good latch and stay-bars, as will be directed.

Provide and fix locks, bolts, and other fastenings, excepting the hinges, to the large wood gates for prisoners' entrance, as also to the wood gates to the entrance at the back of prisons, as will be hereafter described, to the value of not less than five pounds sterling to each. Provide, hang, and fix two pair of open cast-iron folding gates, with fixed top and wicket gate to prisoners' entrance, and corresponding entrance to stable-court, with iron rollers and kirb, and to be in every respect as shown upon the drawings. Provide for locks, bolts, and other fastenings to these gates which will be hereafter described, to the value of not less than five pounds sterling to each gate.

Provide and hang an open iron gate, with proper locks and fastenings, to the doorway of the passage leading to prisoners' box in court, according to the drawing for the open iron gate, fastenings, &c. for the passages in the prisons.

Provide and fix an iron door, and fastenings to the doorway of the lock-up room adjoining the prisoners' entrance, as described for the cells in the prisons.

Provide and fix wrought-iron rail and spikes, screwed to the partitions of prisoners' box, and in front of spectators' seats in court; also to the divisions of the prisoners' seats, and to the partitions of the debtors' and female prisoners' pews in the chapel, according to a drawing full size for the same.

Provide and fix two circular cast-iron racks in the stable, with bars and rims, forming a quarter sphere 2 feet 6 inches diameter.

Provide and fix cast-iron open enclosure to prisoners' seats in the chapel, with iron gates and locks, of the value of twenty-one shillings, to each division; and wrought-iron horizontal bar at top and bottom, as shown in drawing of iron railing and gates for prisoners' airing courts. The bottom bar to be securely fixed to the floor timbers, and the whole securely fixed to the wood partitions and side walls, also rivetted to the iron columns.

Provide and fix two cast-iron columns, with caps and shoes, in the chapel, firmly screwed and secured to the carcass timbers.

Provide and fix doors, with ventilators, to cells, iron gates and bars to the passages, staircases, and lobbies, in the upper story of the prison building, of the sizes and dimensions shown and described upon the drawings. Provide and fix also cast-iron girders and shoes over the day rooms in this story, according to a drawing at large for the same. Provide and fix cast-iron gratings and shutters to windows, with one square of glass to each shutter, to the cells, described in plans, on this story, according to drawings; and cast-iron gratings of a different pattern to the windows of the keeper's, and back of prisoners' staircases, and where otherwise shown or described upon the drawings.

Provide and fix on the one pair story of the prisons, and keeper's house, doors with ventilators to cells, iron gates, and bars to the passages, staircases, and lobbies, cast-iron gratings, and shutters to windows. Cast-iron girders and shoes over the day rooms, as last described, for the upper story, varying in number and sizes, as shown or described on the drawings.

Provide and fix on the ground story of the prisons, gratings and shutters to windows, doors with ventilators, &c. to cells. Iron gates and bars to the passages, staircases, and lobbies, girders and shoes to day rooms, as before described, for the upper story, varying in number and sizes, as shown and described upon the drawings.

Provide and fix wrought-iron hand-rails, 2 inches wide, and half an inch thick, properly ramped, wreathed, and twisted, where necessary, with wrought-iron balusters, 1 inch square to each step, to be let into the steps and landings, and well run with lead, and securely rivetted to the hand-rail, and wrought-iron newels, 1½ inch square, to the bottom steps, the whole fixed in a secure manner to the staircases in the prisons, and keeper's house, and the two staircases leading to the infirmaries.

Provide and fix cast-iron gratings to the windows, and over the doors, in the other parts of the different buildings, where shown, and as described on the drawings; also to the stone kirb of the basement windows in front of the keeper's house, and where otherwise required.

Provide and fix small cast-iron gratings in the external walls under the ground-floor of the different buildings, for the free circulation of air, as indicated by the openings made in the plan showing the drains, &c., also where may be directed.

Provide and fix iron linings, 9 inches by 3 inches, and 14 inches deep, in the walls of each cell and day rooms, for ventilation, according to drawing at large, securely let in and tailed in brickwork, where may be directed.

Provide and fix cast-iron inspection holes in each of the day rooms, according to a drawing at large, securely let in and tailed in the brickwork, where shown upon the drawings.

Provide iron railing and kirb, with gates, locks, and fastenings, and stay-bars, with kirbs to same, according to drawing at large, containing also farther description of same, to the front of the prisoners' airing courts, including those to the infirmaries, as shown upon the drawings.

Provide iron railing and kirb, with stay-bars and kirbs to same, according to aforesaid drawing, but without gates or fastenings,) to be securely fixed between the piers, &c., of the boundary of prisoners' airing courts, as shown on the drawings.

Provide and fix small cast-iron grating over the drains throughout the different buildings, as shown on the drawing of the drains.

Provide and fix two cast-iron girders, with shoes 18 inches long and 1 inch thick, under each of the two cisterns in the prisoners' airing courts, according to drawings.

Provide and fix cast-iron trough gutters, with ovolo moulded fronts and iron brackets every 3 feet apart, securely fixed in brickwork throughout the different buildings, according to a drawing full size, excepting the roofs of the different buildings which are only one story in height.

Provide and fix iron troughs according to a drawing full size for the same, with iron brackets every 3 feet apart, securely fixed in brickwork to the different roofs before referred to as being only one story in height.

Provide and fix also stacks of cast-iron rain-water pipes, 4 inches diameter, with joints made perfectly water tight, and with dragon spikes in the prisoners' airing courts, and where otherwise shown, and rain-water heads with overflow pipe at top projecting 4 inches with convex gratings in each; the whole to be securely fixed to the walls throughout the different buildings, where shown or described upon the drawings.

Provide and fix 3-inch cast-iron service pipes from cisterns in prisoners' airing courts, properly turned for the plumber's lead pipes, and fixed complete where shown on the drawing of the drains.

Provide and fix cast-iron scrapers, value three shillings and sixpence each, let in at the sides of each of the external doors.

Provide also five box ornamental scrapers, value seven shillings each, to the entrance door under portico and the side entrances adjoining, to be let in and leaded into the stone-work.

The contractor for the iron-work and smith-work must provide all the lead and coals required for fixing his own work; he must also provide all moulds and patterns required for the execution of his work (which are to be submitted to the architect before cast or worked) according to the aforesaid particulars, and in the manner shown or described upon the drawings. All the iron-work is to be secured from rust by a strong coat of anticorrosive paint applied as soon as possible, and before exposed to the open air.

All the wrought iron-work is to be of the best English charcoal iron-work; all the castings to be of the best quality and perfectly sound, and the quality and strength of every article must be submitted to a full proof before it is used, at the expense of the contractor.

Slater. The roofs of the different buildings shown or described in the drawings, excepting the roof of the portico, are to be covered with sound countess' slates of the best quality, laid on battens with three strong copper nails to each slate, the third slate overlapping by 2½ inches the head of the first, the course under the eaves to be solid throughout; the battens will be provided by the carpenter, but the slater is to attend him in setting out the same. The whole of the slating is to be left by the contractor for the same, complete and perfect in every respect at the completion of all the works.

Plumber. Cover the roof of the portico with cast-lead, eight pounds to the foot superficial, the joints to be well dressed round the rolls provided for them, which will be fixed 3 feet apart, the lead at the valley to turn up under the slates at least 9 inches; form two gutters, as shown in the drawings, with proper laps and flashings to convey the water through the blocking-course to the roof below.

Provide and lay cast-lead gutters, eight pounds to the foot superficial, over the magistrates' and grand-jury buildings, where shown upon the drawings; the head to turn up under the slates at least 9 inches, with proper and sufficient drips to the same, and cesspools at each rain-water head, the whole as shown upon the drawings.

Cover the ridge and hips over the court-room, keeper's house, and prison buildings, with milled lead, six pounds to the foot superficial, and 22 inches wide, dressed down upon the slates, and well secured to the roll, and to lap at the meetings at least 6 inches. Cover the remaining hips and ridges throughout the different roofs with milled lead, six pounds to the foot superficial, and 18 inches wide, well dressed down on the slates and secured to the ridges and hips, to lap at the meetings at least 6 inches. Put flashings to the top and sides of lean-to or shed roofs, with milled lead, six pounds to the foot superficial, well dressed down upon the slates, to lay upon the slates 6 inches, to turn up 3½ inches, and let into a groove 1½ inch.

Put flashings of the same description round the skylights and chimney-shafts, with gutters of cast-lead, eight pounds to the foot superficial, where necessary. Lay valleys where shown on the drawings, with milled lead, six pounds to the foot superficial, to turn up under the slates at least 9 inches, and to be 2 feet wide.

Provide and fix three two and half pumps, with proper lead buckets and suckers, iron handles, 2-inch pipe from bottom of wells, and all apparatus complete, excepting the wood-work.

The two pumps in the prisoners' airing courts to be made so as to force the water into the cisterns, with two handles to each, in order that the prisoners may work the same, in each of the mill airing courts, without communication with either.

Line the cisterns in the prisoners' airing courts with milled lead, the sides to be six pounds, and the bottoms eight pounds, to the foot superficial, well soldered together. Provide and fix inch ball-cock and service-pipe to the same, with 2-inch waste-pipe, 1 foot below bottom of cistern, and securely soldered thereto.

Provide and fix 1½-inch pipe from iron services, shown on drawings, to all the privies, and 1½-inch brass cocks to each as shown on drawings; those to the front buildings, including the privies adjoining the hospital wing, to have an iron pan and trap under each, with the cocks fixed under the seat, as will be directed; and those to the remaining prisoners' airing courts at the back, or jail building, to have the cocks made without handles, for a key, which is to be provided for each.

Provide and fix three-quarter inch service-pipes, with three-quarter inch brass cocks, securely soldered to the nearest junction of the iron services from cisterns, to supply each of the sinks at the end of the prison passages, also in the prisoners' wash-house, kitchens of the keeper's house, wash-house adjoining prisoners' entrance, and to each of the prisoners' airing courts, as shown and described upon the drawings.

Provide and fix 2-inch washers and wastes and plugs to all the sinks shown in the drawings or described in the mason's particulars, with 2-inch lead pipes and a stink trap from the same into the drains outside the external walls, those at the end of the passages to turn into the rain-water pipes, a hole to be made in the same to receive the said pipes.

All the lead or plumber's work to be provided by the contractor, to be of the best quality, and to be weighed in the presence of the architect, or his clerk of the works, proper notice being given for that purpose.

Plasterer. The stiles, rails, and panels to the ceiling of the portico to be lathed with stout laths, floated, and rough stuccoed, jointed, coloured, and tinted to imitate stone-work; the frieze under the same to be rendered, floated, and set with rough stucco, jointed, coloured, and tinted as before.

Run a moulding in panels and cornice top of frieze, as shown in the drawing. Render, float, and set the sides of the four chimney-shafts in the front buildings with Roman cement stucco, (not less than three-quarter inch thick at any part,) jointed, coloured, and tinted, to imitate stone-work, and run a moulding round same as per drawing; the joints to be from 18 to 24 inches apart.

Lath with stout laths, float, plaster, and set, and whiten the ceiling of the court-room and entrance passages, and run a cornice round the court according to drawings.

Render, float, and set the sides of the court-room and entrance passage with rough stucco, jointed, coloured, and tinted according to drawing; and lath, float, and stucco, as before described, the passage side of partition in same. Run a stucco moulded impost round the sides of the court-room, as shown upon the drawing.

Lath, plaster, float, set, and whiten the ceilings of the rooms and passages of the grand jury and magistrates' wings, and run cornices round same, as per drawings. Lath, plaster, float, set, and colour the partitions or battening; and render, float, set, and colour the sides of the rooms before described, except the sides of the magistrates' room, which are to be trowelled stucco; and lath, plaster, float, and stucco the partitions; and render, float, and stucco the partitions; and render, float, and stucco the walls of the passages and lobbies in the aforesaid wings; to be coloured, jointed, and tinted as before described for the court.

Lath, plaster, set, and whiten the ceilings of the privies and rooms adjoining the wings last described. Also of the rooms, passages, and staircases of the infirmary wing, the wash-house, sitting-room, and lobbies for the gate-keeper, at the prisoners' entrance; also of the rooms, passages, staircases, and chapel of the keeper's house, and prisoners' staircases adjoining end of the prisoners' wash-house. Lath, plaster, set, and colour the partitions; and render, set, and colour the sides of the privies and rooms adjoining the grand jury and magistrates' wings, and the rooms, entrance-hall, passages, and staircases of the keeper's house. Lath, plaster, set, and whiten the partitions in the infirmary building and prisoners' wash-house, and all partitions where the walls are not described to be plastered.

The whole of the remaining walls internally, to the cells, passages, and staircases in the prisons, and all the rooms, passages, lobbies, entrances, and staircases, and cellars throughout the different buildings, excepting the walls before described to be plastered, are to be lime-whited twice with hot lime, excepting the chapel walls, which are to be coloured twice with lime and ochre, to imitate light wainscot.

The plasterer is to make all quirks and arrises where necessary; and is to find and provide himself with all copper-moulds, floating rules, and other implements necessary for completing his work; and whatever damage is done, by any other workmen, to the plastering, during the progress of the works, must be repaired by, and at the expense of, the contractor for the plasterer's work. He is also to make good after all workmen, when and where required. And all other defects in the plastering, arising from blisters, or any other improper workmanship, must be repaired, and the work made good at his expense.

Painter. The whole of the internal door and window frames, shutters, sashes, railing, wood and iron doors, pewing, wainscotting, skirting, and other internal wood or iron work, described in the before-mentioned particulars, or shown in the drawings, or usually painted, is to be properly oil knotted, brought forward, and painted three times in good oil colour. The wood partition and doors at back of spectators' gallery, sashes and frames, and other deal work in the court-room, to be finished and grained Dutch wainscot, and varnished. The walls of the magistrates' room are to be painted four times in oil, buff colour.

The whole of the external wood and iron work throughout the different buildings, including the front iron railing, usually painted, and not otherwise described, is to be properly oil knotted, brought forward, and painted four times in good oil colour, to be finished of such common colours as the architect shall direct. The doors and frames of the side entrance and under portico to be finished and grained Dutch wainscot, and varnished.

The iron gutters and cistern-heads to be finished stone colour.

Glazier. The whole of the sky-lights, lights over doors; windows, sashes, borrowed lights, &c. shown or described upon the drawings, or in these particulars, are to be glazed with second Newcastle crown glass; the borrowed lights in ceiling of grand jury and magistrates' wings, to be of ground glass. The iron shutters to the cells are to be glazed with knots; and the whole of the glazing is to be left whole, clean, and perfect by the glazier, at the completion of the works; and to be performed in the most complete and workmanlike manner.

General conditions. The following conditions and observations are to apply, and to be strictly attended to, in all proposals which may be made for the execution of any of the foregoing works:—

The contracts are to be entered into with

The whole of the materials herein provided, are to be of the best in quality of their several kinds, sound, and well seasoned, and to be applied in the most substantial and workmanlike manner, under the direction, and to the entire satisfaction, of
the architect.

The drawings are to be equally binding with the specification; and should any thing appear to have been omitted in either, or both, which is usually considered necessary for the completion of the several works, the contractor is to execute the same, as if they had been particularly specified, and is to obtain no advantage by such omissions, but shall supply whatever may be wanting to complete the whole: and all the buildings are to be left in a complete state, according to the true intent and meaning of the drawings and specification; and the directions for their correct performance, as given from time to time by the architect, or through his clerk of the works, are in all cases to be strictly adhered to.

The whole of the bricks, lime, stone, timber, slate, iron, lead, or other materials, to be delivered on the premises; and to be examined by the architect, or his clerk of the works, previous to their being worked or used in the building.

No contractor is to suffer any part of his work to be underlet, or let at task-work; but all the labour is to be done by his own workmen, and paid for by him in days' wages.

It shall be in the power of the architect to reject any part of the materials which he may think unfit for the work, or to cause any part of the work to be altered, which is, in his opinion, unsound or unworkmanlike, and not according to the contract, upon three days' notice having been given in writing for that purpose, by the architect, or his clerk of the works; and in case any contractor shall refuse or delay to rectify the same, or comply with the orders that may be so given to him in writing, or shall perform all or any part of the works in an improper manner, or in case the works do not proceed with proper despatch, the magistrates shall have power, and be at full liberty, to suspend the further execution of the works by the said contractor, to take it out of his hands, and employ or engage any other person or persons to perform and execute, and to find proper materials for the same; in which case, the costs and charges thereof shall be paid or allowed to the magistrates, by the contractor or his sureties, or retained or deducted out of the moneys which may be then due, or become due to the said contractor; the amount of which shall be valued and decided by the architect, whose award in this, and in all cases respecting the works, shall be final.

It is also to be in the power of the architect to direct such alterations to be made in the work during its progress, as may be found expedient; which alterations shall not vitiate or make void any of the contracts, but shall be performed by the contractors according to the directions they may receive; and the value of the same, whether an addition or deduction, is to be ascertained by the said architect, and to be added to, or deducted from, the amount of each contract, according to the rate at which the work was undertaken; the award of the architect in such case to be final.

No allowance will be made to any contractor for extra or additional work, unless the same shall have been ordered in writing by the architect, and unless an account or voucher of the said work is delivered to the architect, or his clerk of the works, within three days of its performance.

The contractors are to provide themselves with all manner of labour, tools, implements, scaffolding, ropes, ladders, hoisting-tackle, materials of every description, carriage, freightage, and every requisite for the completion of their respective works; they are also to make good all damage or defects which may be occasioned, whether from carelessness or other cause; the contractor repairing the said damages or defects, is to charge the expense to the parties by whom they may have been occasioned, and the magistrates are not to be charged with the same. The workmen of the different contractors must attend to give the necessary assistance stipulated for each other in the execution of their work, when required to do so by the architect, or his clerk of the works. Each contractor is to clear away from time to time, when directed to do so by the architect, or his clerk of the works, all rubbish occasioned by the performance of the works contracted for by him.

Should it be deemed necessary at any time to suspend the works, or any part of them, on account of weather or any other cause, the architect shall be at full liberty to do so, and no extra charge shall be made on this account by any contractor.

The architect is to be at full liberty to order the discharge of, or dismiss from the works and premises, any man or men for incompetency or misconduct, and the contractor or contractors shall not replace them without the approbation of the architect.

Should any of the materials be lost or stolen from the premises, no allowance will be made to any contractor for the same.

For the convenience of the contracting parties, and for the general security of the materials, &c. belonging to them, a gatekeeper will be stationed within the premises until the buildings are completed, and the wages paid to him will be charged to all the contractors in proportion to the amount of their respective contracts, not exceeding twopence in the pound sterling.

The works shall be begun as soon as the contracts are signed, the front range of buildings must be covered in by and the whole of the works must be completed by and in case of extra works, an extension of time will be allowed of one week for every hundred pounds value of such extra works.

The tenders are to be delivered at on or before

Every tender must state a specific sum for which each branch of the works will be undertaken, subject to the conditions contained in this specification; and every person offering a tender must deliver with it a sealed paper, containing a copy of the estimate, with the quantities and prices on which such tender is founded, in order to show that it is made on a bonâ fide calculation. The sealed paper of the accepted tender only will be opened, and the copy of the estimate contained therein, must be left with the architect, in order that he may be enabled to value any additions or deductions which may arise, according to the prices of such estimate.

Each contractor must enter into a bond, with two proper sureties, approved by the magistrates, for the due performance of his contract.

The contractors will receive payments by instalments from the magistrates, upon application being made to them, as the works proceed, when each quarter of their respective works shall have been performed, upon producing a certificate from the architect, that the amount applied for does not exceed three-fourths of the value of the said work.

The balance to be paid within six months after the architect shall have certified that the contracts have been duly performed and executed.

The utility of specifications are too well known, to require any apology for our annexing to the above a specification of another description.

Specification of works to be contracted for in building stables, &c. at the for according to drawings numbered.

Bricklayer, &c. The ground is to be excavated for all the walls, drains, cesspools, &c., allowing sufficient width for the workmen; it is afterwards to be filled in to the proper level, and well rammed.

The whole of the mould or other loose earth, occupied by the stables, coach-house, harness-room, court-yard, &c. is to be excavated, and carted away. The said space is afterwards to be filled in with dry rubbish, well rammed; and the space occupied by the coach-house, and court-yard, is to have a coat of gravel, not less than 3 inches thick at any part, and to be laid in a workmanlike manner, with a current, from the end of the coach-house and the cross fence-wall to the dungpit, of not less than 2 inches in every 10 feet.

Cut away and take down the brickwork between the piers of the outside fence-wall, and part of one of the piers. Cut out the indents in old wall, and rebuild 18-inch piers, &c., splayed, &c. as shown in the drawings. The top course and outside weather of courses to be built of Roman cement, of half cement and half sand.

Assist the carpenter in taking out the present garden door and frame, and cut out indents in old wall, take down the brickwork above, and brick up the whole space; the top course and outside of weather courses in cement, as before stated.

Take down, and clear away to the foundations, that part of the old fence-wall adjoining the party-wall of
leaving a toothing into the walls. Clean and sort such of the old bricks as are perfectly hard and sound, which are to be used in the different works; fill up the space at each end of the party-wall with new brickwork, properly flushed with mortar. Assist the carpenter in shoring up the old party-wall, if it should be found necessary.

The whole of the walls, &c. are to be built of the heights and thicknesses, and in the manner shown or described in the drawings. All the brickwork to be done with hard-burnt, sound, grey stocks of the best quality, to be approved of by the architect, selecting the best and most even of them for the outside; the joints to be well bedded, and flushed up with mortar at every course; the mortar to be made with hot lime, thoroughly screened and slacked, and clean sharp Thames sand, or other sand equally approved by the architect, in such proportions as shall be directed, not less than one bushel of lime to two bushels of sand in any part.

Cut all indents, splays, skew-backs, &c. required, and bed and point all the sash and door frames. Cut a groove 2 inches deep in the party-wall of house adjoining, for the lead flushing.

Flues, 14 inches by 9 inches, are to be made from the coachman's room and harness-room, and to be well pargetted. The shafts to be carried up above the top of the party-wall of house adjoining, and iron straps (which will be provided by the smith) are to be fixed by the bricklayer. Turn a trimmer in half brick, under the slab of the coachman's room. Provide two third size chimney pots, and set the same securely with plain tiles in cement, at the top of the chimney-shaft.

The brick drains and six cesspools, in and out of the building, are to be built as shown in the drawings, with Roman cement, of half cement and half sand, and rendered inside with the same, not less than half an inch in thickness.

Provide and lay a stone pipe, 4 inches diameter in the clear, from the tank to the ditch or sewer.

The sides and bottom of the tank are to be rendered with Roman cement, of half cement and half sand, not less than three-quarter inch in thickness.

The whole of the stable, except the space under the manger, and stone channel, is to be paved with Dutch clinkers, and laid on edge in sand, with a fall of 2 inches from the partition of the harness-room to the sink stone, 2½ inches from the manger to the stone channel, and 1 inch from the partition of the coach-house to the stone channel; the paving between the last-mentioned partition and channel is to be laid herring-bone. The spaces under the mangers, small corn-bin, and bottom of dungpit, are to be paved with brick flat paving, laid in mortar. The ground is to be laid to the current before described, and well rammed, to receive the whole of the said paving.

The bricklayer is to lay half brick-sleepers, two courses high in mortar, under all the joints of the stone paving in the harness-room.

All the brickwork is to be built truly level, straight, and perpendicular, and the plates, &c. are to be properly bedded in mortar.

The bricklayer is to find and erect all the scaffolding necessary for the performance of the said brickwork, and other works required, and take down and clear away the same at his own expense.

Carpenter and Joiner. Provide and fix turning pieces to chimneys, doors, and windows, and turning piece to trimmer of coachman's room, and centering to arch under tank, and arch under recess in harness-room.

Prepare and hang 2½-inch wrought, ploughed, tongued, and beaded gate to entrance court, with a rounded and rebated capping on the top, the whole connected together by four three-quarter-inch screw bolts, with nuts and plates, (to be provided by the smith,) but carefully let in and securely fixed by the carpenter, and fillets, countersunk, screwed on each side. Provide and hang one of Collinge's patent hinges, 5 feet long at the bottom of the gate, cranked with a stay 6 inches deep, (to be let in and leaded by the mason,) and countersunk beaded screws to the same. Provide and hang one hinge as last, for the top of the gate, with a strap 21 inches deep in the pier, and calked down 6 inches in the brickwork, (2 feet 3 inches long in all,) the whole as shown on the drawing. The bottom hinge to be provided with a stop bolt. The prime cost of these hinges may be had on application at Collinge's manufactory, Bridge Road, Lambeth. Provide and fix, also, a two bolt brass warded, mortise gate-lock, and box staple with two keys, value fifteen shillings, and two 10-inch strong bolts, staples, and screws, and large oak bricks of the same size as described for the stone-work, let into the piers for the same. Provide and fix an oak brick in the pier of the cross-wall, with an iron catch to keep the gate open.

Take down, repair, remove, refix, and rehang the present door and frame and lintel, where shown at the new cross-wall.

Frame and fix an oak wrought kirb to the dungpit, 4 inches by 2½ inches in front, and 5 inches by 4 inches at the back, the sides cut bevel, with 1¼-inch deal wrought, ploughed, tongued, and ledged flap, and frame hung with 18-inch cross garnets and nails, and a ring fixed on the flap, with an oak brick and iron catch in the wall, to keep the door open when necessary.

Frame and fix an oak wrought kirb to the top of the cistern, with 1¼-inch flap, &c. as last described for the dungpit, cut for circular iron pipe, but no ring or catch. The top of the flap to project 2 inches over the brickwork.

Cover the roof with half-inch rough boarding for slates, securely nailed to the rafters, also three-quarter inch featheredge tilting fillets, 3 inches wide, to eaves hips and party-walls, and a small inch gutter and bearers at one side of the chimney-shaft.

Frame and fix the roof in the

manner shown and described on the drawings, the scantlings to be as follows:—

Rounded ridge wedged in party-wall..........	8×2
Rounded hips tailed in plate, and secured to angle tie by the upright bearer, 4 inches by 2½ inches, notched and nailed to each other ..	11×2
Common rafters tailed on wall plate, calked down on purlin, and cut and secured to ridge and hips, part of ditto to form ceiling of coachman's room, and nailed with 6-inch two shilling nails	4×2
Trimming ditto framed together round chimney, purlins framed together at hips, and calked down on template 2 feet long, 4 inches by 2½, and firmly secured to upright bearer on wall plate ..	6×4
Struts to purlins, halved and nailed together, and notch-tailed on partition, part of ditto to form ceiling joists of coachman's room ..	4×3
Remainder of ceiling joists of coachman's room, notch-tailed on plate of partition, and cut, and firmly secured to purlins	4×2
Three dragon ties, 5½ feet long each, dovetailed and spiked at each end on wall plate	4×3
Upright quarter halved and nailed to ridge and head of partition for vane	3×3
Wall plate halved and spiked at the angles, without any other laps	4½×4

Provide and lay inside lintels, 4½ inches by 3 inches, to windows of loft and coachman's rooms, and to loft doorway, each 18 inches longer than the openings.

Provide and lay one tier of bond, 4 inches by 2½ inches, 3½ feet above the loft floor, not to be cut out of openings until directed by the architect. Provide and lay also wood bricks for the jambs of windows, door, skirting of coachman's room, hay flaps, &c.

Provide and fix rough fillet to angle of partition for plasterers, cut away for and assist the smith in fixing the vane.

Frame and fix quarter partition forming the coachman's room, as shown in drawings, the heads and sills let into the walls 4 inches, the quarters 13 inches from centre to centre, and the scantlings to be as follows:—

Heads	4×3
Sills	4×2½
Angle post	5×4
Remaining posts, principal quarters and braces	4×2½
Common quarters	4×2
Upright quarters above head at door side, halved and nailed to purlin and rafters, &c.......	4×2
Head and sill, and angle post to opening for hay flap	3×3
Common quarters to sides and top of ditto......	3×2

Cover the loft sides of the partition last named, and the sides and top of the opening for hay flaps, with half-inch rough boarding, securely nailed to the same.

Prepare and fix deal cased frames, oak sunk sills, and half-inch deal ovolo sashes, single hung with iron pulleys, white lines, iron weights, and sash fastenings complete to the windows, of loft, and coachman's room, and rounded nosing to bottom of same.

Prepare and fix an inch chimney shelf, 4½ inches wide, with a rounded corner and plugged.

Prepare and fix three-quarter inch deal skirting, 4½ inches wide, and ploughed for plastering, round coachman's room.

Frame and fix a proper door frame, 4 inches by 3 inches, with mortises 2 inches square, and three-quarter inch deep in bressummer. Prepare and hang inch deal wrought, ploughed, tongued, and ledged door, with 18-inch cross garnets, padlock, hasp, and staple.

Prepare and fix inch rebated and rounded lining, ploughed for plastering, and prepare and hang 1¼-inch four panel square door, with one pair 2½-inch butts and screws, a 6-inch iron rim, two bolt lock with brass knob.

Frame and fix a corn bin in the loft, 7 feet by 4 feet 3 inches, and 3 feet 6 inches high, with inch rough sides and top, with two flaps hung with 12-inch cross garnets, and a padlock, hasp, and staple to each. Three divisions are to be formed under one of the flaps, and the whole of the inside is to have proper framed skeleton grounds or bearers to receive the sides, top, &c.

Frame and fix inch rough sides, cut bevel, with inch flaps and frames to hayloft, hung with 10-inch cross garnets, and proper bearers inside.

Frame and fix the floor of joists, and trim the same for stairs, chimney, and two flaps, the whole to be executed in the manner shown or described upon the drawings, and of the following scantlings:—

Common joists calked down 1 inch and firmly secured on wall plates, girder over columns, and head of coach-house partition	8×2¼
Trimming ditto ditto	8×3
Wall plates on party-wall and external wall opposite, to tail on the walls within 4½ inches of the outside, the external plate to have a mortise tenon in the bressummer	4×3
Girder calked down 1 inch on template, 5 feet long, 9 by 3, as lintel to window of harness-room, chase-mortised in front post, and cut for caps of iron columns	6×4

Provide and lay inch wrought folding floor to the coachman's room and landing of stairs adjoining, and inch rough folding floor to the remainder of loft story.

Provide and fix inch steps, risers, and proper carriages, with rounded nosings, to stairs ascending from the harness-room to the loft, with string boards complete. Prepare and fix a wrought and framed newel, let into the paving and hanging stile at the fifth step. Prepare and hang an inch two panel square door, hung with 2-inch butts, and thumb-latch to the same. Prepare and fix inch wrought spandrel wainscotting to enclose the space under the stairs, and prepare and hang an inch two panel square door to the same, hung with a pair of 2-inch butts, and a thumb-latch fixed to the same. Prepare and fix an inch rounded nosing on the brick set-off at the top of the stairs, with bearers to same.

Frame and fix quarter partitions in the stables, the heads and sills let into the wall 4 inches, and mortised 13 inches from centre, and the whole to be executed as shown in the drawing, and of the following scantlings:—

Heads................	4×3
Sills	4×2½
Post in coach-house partition, adjoining harness-room partition ..	6×4
Remaining posts, principal quarters, braces, and door heads	4×2½
Common quarters	4×2

Frame and fix a bressummer, 11 inches by 9 inches, wrought three sides over the story-posts in front of the stables, mortised for the head of the partitions and the wall plate, and four mortises in soffit, 2 inches square, and three-quarter inch deep for the story-posts, sunk and rebated at top for the opening of loft door, and stop rebated in soffit for two sashes, and holes cut for iron bars. Prepare and fix a wrought stop in soffit, 2 inches by half inch, screwed to bressummer, for the coach-house gates. Fit and fix three bolts through bressummer, and strapped to girder head of partition and wall plate, and cover heads of bolt holes in front of bressummer.

Prepare and fix a story-post, 9 inches by 9 inches, for the hanging stile of the coach-house gate, wrought three sides, and rebated with a tenon into the bressummer 2 inches square, and three-quarter inch deep, and one ditto in stone plinth, 2 inches square and 1½ inch deep. Prepare a story-post, 9 inches by 7 inches, for the hanging stile of the stable door, worked as the last, but double rebated and framed to transom. Prepare another story-post, 9 inches by 4½ inches, worked in every respect as the last, but one of the rebates to stop at bottom of the sash. Prepare one shorter ditto of the same scantling, and worked in every respect as the last, but single rebated. Prepare and frame, and fix a wrought weather and double rebated transom, 9 inches by 4 inches, mortise-tenoned into the door-post, and a wrought, rebated and weathered sill, 9 inches by 3½ inches, to the window, mortise-tenoned 1½ inch into the posts.

Prepare and fix 1½-inch deal sash over stable door, and mitred bead to ditto inside. Prepare and hang a pair of 1½-inch folding sashes with 2-inch butts, a brass button, and two small bolts. Prepare and fix inch deal rounded jambs, and 1¼-inch window board and bearers, 5½ inches wide, to the window, &c.

Prepare and hang 2-inch deal wrought both sides, ploughed, tongued, and beaded door to entrance of stable, and fillets with countersunk covered screws on each side, the whole connected together by three five-eight-inch screw-bolt, nuts and plates, (to be provided by the smith,) but let in and securely fixed by the carpenter, hung with a pair of Collinge's patent cast-iron butts, (to be provided by the carpenter,) with a stop to the bottom hinge, a 12-inch stop-lock with two keys of unexceptionable quality, a stable-door latch, and two 9-inch bolts and staples fitted and fixed complete, with inch rounded lining, 5½ inches wide, adjoining window.

Prepare and hang a 2½-inch coach-house gate, wrought two sides, ploughed, tongued, and beaded, and fillets countersunk, screwed and covered on each side, the whole connected together by four three-quarter inch screw-bolts, with nuts and plates, (to be provided by the smith,) but let in and securely fixed by the carpenter, hung with a pair of Collinge's patent 5-feet gate hinges, (to be provided by the carpenter,) with a stop bolt to the bottom hinge. Cut three circular holes, 6 inches diameter, in the gate, where will be directed. Provide and fix also a strong bent hasp and staple, with an iron stop chain and ring, a 36-inch strong bolt at top, with iron-plate fitted in bressummer, the end of the bolt to be tapered. Provide and fix also a 9-inch bolt at the bottom. Provide and fix an oak brick in the pier of the cross-wall, with an iron catch to keep the gate open.

Prepare and fix 1½-inch wrought oak skirting, 6 inches high, for the carriage wheel in the coach-house, fitted to the stone lintels of story-posts, and securely nailed to oak spurs, 18 inches deep, driven in the ground as shown in the drawings.

Prepare and hang 1¼-inch two panel square door from stable to coach-house, 6 feet high and 2 feet 4 inches wide, with 2-inch butts, and a thumb-latch, and inch rounded and rebated lining to ditto, and an oak wrought and weathered sill, 4 inches by 3 inches, let into the posts of partition.

Provide and fix 1¼-inch wrought and framed sides and bottom of sink, with wrought and framed legs, the sink 2 feet long, 8 inches wide, and 7 inches deep in the clear inside, securely fixed to partition, and cut away for plumber where necessary.

Provide and fix 1½-inch wrought both sides end of closet, 6½ feet high, 11 inches wide, inch wrought, rebated, and rounded top and bottom and bearers, inch wrought and framed front, with two panel square folding doors, 8 feet 10 inches high, 3 feet 6 inches wide, hung with 2-inch butts, a cupboard lock, and two small bolts fixed to same. Two inch shelves, wrought both sides, and bearers inside, and one ditto under the whole, securely fixed to partition.

Prepare and fix inch wrought and rounded stop 12 inches wide, with inch wrought risers and proper bearers, 1½-inch wrought two sides lining 13½ inches wide, inch wrought and beaded fascia 5 inches wide, with 1½-inch wrought harness rail, 5 feet long, and 4 inches wide, with three strong wrought, dovetailed, and cut harness brackets, 10 inches projection, the whole to be securely fitted and fixed to partition.

Prepare and fix inch wrought front 2 feet wide, and return end 5 inches wide, 2 feet 9 inches high, and inch framed top, and clamped flap with rounded nosing to small corn-bin in stable; also three-quarter inch, 3-inch square in clear, corn shoot, with elbow to ditto; cut holes for and fit the same in large corn-bin partition, and flap last mentioned, and provide a small sliding stop to the same; and three-quarter inch wrought both sides shelf and bearers over ditto, 8½ inches wide; the whole securely fitted and fixed with proper bearers to partition, &c.

Prepare 1¼-inch four panel square framed door to harness-room, 6 feet high and 2½ feet wide, hung with 2½-inch iron butts, and a 6-inch iron rim two bolt brass knob lock fixed to ditto, and inch single, rebated, and double rounded lining to ditto.

Prepare and fix deal cased frame, sill, sash, &c. in harness-room, as described for the coachman's room above, with three-quarter inch wrought and rounded jambs, and soffit 5½ inches wide, and inch wrought and rounded window board and bearer 6 inches wide.

Prepare and fix three inch shelves, 9 inches deep, in recess adjoining chimney, and cut away brickwork for ends of same.

Prepare and fix an inch shelf to the chimney 4½ inches wide, with a rounded corner, and plugging for same, and three-quarter inch square skirting to chimney side of room, 4½ inches wide.

Prepare and fix 1¼-inch rail, 8½ feet long, with twelve turned pegs, 6½ inches projection; 1½-inch wrought harness rail, 4½ feet long and 8 inches wide, with three wrought and cut brackets, 10 inches projection, and 1½-inch wrought rail, 2¼ feet long, 9 inches wide, with three-quarter inch wrought and cut Arris saddle bracket, 18 inches projection, each side 7½ inches wide, and rounded nosing to ditto, where will be directed in the harness-room.

Prepare and fix 1¼-inch wrought rail, 8½ feet long, with twelve turned pegs, 6 inches projection, against the partition in the coach-house.

Prepare and fix three-quarter inch wrought, ploughed, tongued, and beaded wainscotting in stable to harness-room and coach-house partitions, and brick wall in front of stable. Prepare and fix inch ditto to the back over mangers, with all proper strong and sufficient bearers, excepting that part which will be described of 1½-inch deal.

Provide and fix two iron rings with screwed ring staples to side wainscotting, corresponding with similar ones fixed to iron columns, and two large ditto in front of each of the mangers, as shown in drawings.

Provide and fix two iron screw pulleys in ceiling of stable for a lantern, where will be directed.

Prepare and fix oak wrought and rebated kirbs, 4 inches by 2½ inches, for iron gratings in stables.

Provide and fix 1½-inch partition, and fronts between stalls, and inch ditto enclosing hay-racks as high as the loft floor, the fronts prepared, cut out, and fitted for iron racks, also Arris wood fillets at back of racks, the whole with proper and sufficient bearers; 1¼-inch wrought, splayed, and rebated front and bottom of mangers, and bearers, and cuttings in stall partitions, &c. for same; 1½-inch circular heads and gussets to hay racks, with proper bearers for same.

Provide and fix four tier of bond, where the wainscotting has been described, against brick walls of harness-room and stable, and one tier round the remaining walls and back wall of stable, as will be directed. Provide and fix wood bricks for skirting, &c. on chimney side of harness room, and to window jambs of ditto.

Provide and fix oak posts, supporting manger, &c. at end of stall partitions, wrought all round, cut at the top and rebated, 6 feet long, 4½ inches by 4 inches.

Provide and fix 1½-inch wrought oak skirting, 9 inches high, let into last-named oak post, with three small oak spurs driven in centre.

Provide and fix oak sill, 4½ inches by 4 inches, to stall partitions, wrought, double rounded, and rebated for wood-work above, and ends cut and fixed to columns. Provide and fix 1½-inch wrought two sides, ploughed, tongued, and beaded partition under iron-work, and rounded fillets screwed against ditto, and scribed to iron columns.

The carpenter is to assist the smith and other workmen in fixing all works necessarily connected with his own.

Open spaces are to be left on each side the ends of timbers let into the wall and secured by rough wedges on each side.

The carpenter is to cut away and make good after all other workmen, when and where required.

All the joiner's work must be prepared and put in a state of forwardness at the commencement of the works; the doors and other framing to be put together for the purpose of seasoning, but not wedged up.

All the timber is to be of the best Memel, or other timber equally approved by the architect, to be sawn die square, and free from sap or shakes. The deal to be of best yellow Christiana, or any other equally approved by the architect, free from sap or large or loose knots. The oak to be of English growth, of the best quality, free from sap or shake, and sawn die square. The whole of the materials to be well seasoned.

Mason. Provide and set York window sills, throated 8 inches wide, to the windows of the loft, coachman's room, and stable, the last sill to be let into the door-post half an inch, and have a mortise hole, 1½ inch square, cut for the other post.

Provide and set York sill to doorway of harness-room, and one ditto to entrance door of stable, let into the plinths under the posts.

Provide and set two York plinths, 6 inches high, under the posts in front of stable and coach-house, 7 inches by 9 inches, and one ditto 12 inches by 9 inches, with a mortise in each 2 inches square, and 1½ inch deep.

Provide and set a York channel, 9 inches wide, in stable; the channel to be 6 inches wide, but not to exceed 1 inch in depth.

Provide and set in Roman cement three rough York stones, 12 inches square, under gratings in stalls, and one ditto, 15 inches square, under the sink stone in stable, with a hole cut and rebated in each for a bell trap, (to be provided by the smith,) but fixed and leaded by the mason.

Provide and set one five-hole sink stone, 15 inches square, properly dished, adjoining the dung pit, one ditto 18 inches square adjoining the tank, and one ditto 18 inches square in stable, the last to be cut out for channel before described.

Provide and set two York plinths, 9 inches square, 3 inches thick, for the iron columns, with a hole cut in each, 6 inches square and half an inch deep, and a stub mortise in the same, 1½ inch square and three-quarter inch deep, and the mason is to assist the smith in fixing the columns.

Provide and set in cement York bottom to tank, let into the walls on every side 1½ inch, and if this is not to be procured in one stone, the joints are to be rebated and set in cement; three holes are to be carefully cut for lead pipes.

Provide and lay York paving, jointed and set in cement, in the harness-room, including the back hearth and recess adjoining the same, and the space under the stairs, also under the tank and round sink stone, as shown in the drawings; two holes to be cut in the last for lead pipes.

Provide and set two York stones, splayed, rebated, and cut for top and bottom hinge of entrance-court gate, the iron-work of the hinges to be let in and leaded by the mason.

Prepare and set inch rubbed Portland jambs and mantels, 4 inches wide, 2 feet 2 inches opening to chimneys of harness-room and coachman's room, with four chimney cramps to each, let into York slabs notched for the same. Provide and set also rough York slab and back hearth to the chimney in coachman's room.

The contractor for the mason's work must provide all lead required for fixing the work aforesaid.

Slater. The roof of the stables is to be covered with sound dutchess slates, and nailed with strong copper nails, every third slate overlapping by two and half inches the head of the first. The slates to be well cut, and fitted against the slips, &c. and the whole to be done and left in the most workmanlike manner.

Plasterer. Lath with sound fir laths free from sap, plaster, set up, and whiten the ceilings and partitions of the coachman's room, and the soffit and sides of the opening in partition for flap in hayloft; also the ceilings of the stable, harness-room, and coach-house, and strings of stairs, excepting that part in the closet under stairs.

Render, set, and whiten the brick sides of the coachman's room, and the chimney side of the harness-room.

The ceiling of the coachman's room is to be lathed before the slating is laid.

Smith. All the cast-iron work must be of perfectly sound castings, all the wrought iron to be of the best quality.

Provide and fix a vane 4½ feet above the roof, and 3 feet under, with the letters N S E W firmly secured to the wood-work below the upper part, as shown in the drawing; a half sphere to be cast at the ridge part to admit of plumber's flushing.

Provide two iron tie straps for the chimney-shaft, 2 inches wide, and half-inch thick, with staples to fix in the brickwork: these will be fixed by the bricklayer

Provide three wrought-iron straps, three-quarter inch by 1½ inch, 2 feet long each, with a nut at one end, screws and holes drilled at the other, to secure the girder to the plates and partitions: these will be fixed by the carpenter.

Provide and fix cast-iron segment water-troughs, 6 inches wide, 2½ inches deep, with iron brackets fixed in brickwork every 3 feet in length, mitred and fitted together with a stop at each end against the party-wall.

Provide a cast-iron rain-water head, with hole provided for wooden gutter in the roof. Provide one ditto for the head of rain-water pipe in front. Both of these are to be made to let into the trough.

Provide and fix a rain-water pipe, 3 inches diameter in clear, as shown in the drawing.

Provide iron bars, three-quarter inch square, to the windows of stable and harness-room, 3½ inches apart.

Provide and fix two iron columns in stable, as shown in the drawings, with a cap let in and screwed to girder, and base let in half an inch on the York stone, with a steel tenon cast in the same 1½ inch square, and three-quarter inch deep.

Provide and fix cast-iron railing to stalls of partitions, with rings, &c. as shown in the drawings, and firmly secured to the iron columns; the top rail to extend and be fixed in the brick wall.

Provide and fix cast-iron racks with holes drilled and firmly screwed to the wood-work, and two rings fixed to each.

Provide and fix two harness pegs, and one ring to each of the iron columns, at the heights figured in the drawings, with square rivets to the same.

Provide and fix iron nosing to front of partition between racks, securely screwed to the woodwork.

Provide and fix cast-iron nosings to manger, as shown in the drawings, and screwed to the same.

Provide and fix three cast-iron gratings and frames to the top of cesspool in stalls, as shown in the drawings.

Provide and fix four 6-inch bell traps to the cesspool, as indicated in the drawings of the section at large of the drains, &c. and let into the York paving.

Provide four screw-bolts for the large, and four ditto to the smaller or outside gate, each three-quarter inch diameter, and 3 inches less in length than the width of the gates. Provide three ditto to stable door, five-eight-inch diameter; the whole of these with proper nuts and plates.

All defective castings, or other work found insufficient from defective workmanship, are to be immediately replaced.

The contractor for the smith's work must provide all patterns necessary, and all lead required for fixing his work, and make arrangements with the other workmen, if any scaffolding should be necessary for fixing any of his work.

Plumber. Provide and lay three-quarter inch service-pipe from the main to the tank, to rise 2 inches above the top of waste, with all necessary joints, and soldered to bottom of tank, and a three-quarter inch brass cock to the same, and an inch ferrule to the main.

Provide and fix a 2-inch waste-pipe to tank, secured at the top by a small iron stay fixed in brickwork, and soldered to the bottom of the tank, with a three-quarter inch brass cock outside and 18 inches of pipe through 9-inch wall, and stone bottom of tank soldered to bottom, &c.

Provide and lay half-inch pipe from tank to sink in stable, soldered to bottom of tank, to rise 3 feet above the level of paving, with all the necessary joints, and half-inch brass cock to the same.

Line the bottom and sides of the sink with cast lead, not less than eight pounds to the foot superficial, with an inch washer and waste, and one-quarter inch waste-pipe into the drain.

Cover the hips and ridges of the roof with milled lead, four pounds to the foot superficial, dressed down upon the slates, and well secured to the woodwork, to be not less than 12 inches wide, and to lap at the meetings at least 6 inches. Put a small flushing to the bottom of the vane. Provide and lay a flushing as last described against party-wall and round chimney, but eight inches wide, with a small gutter, six pounds to the foot superficial, at one side of the chimney-shaft 9 inches wide, and to lay under the slate at least 6 inches, and to turn up against chimney-shaft 4 inches.

The whole of the materials aforesaid to be of the best quality, and applied in the most workmanlike manner.

Glazier. Glaze the sashes of the loft, coachman's room, harness-room, and stables, with second crown glass, to be well puttied, and left whole, clean, and perfect at the completion of the work.

Painter. Paint all the usual wood and iron work, &c. outside of the building, including both sides of the outer gates, and the inside of the coach-house and stable door, gates, posts, and linings. Wood-work inside of the tank four times in oil, stone colour, or other common colour, as may be directed; and the old removed door and frame to garden twice in oil on both sides.

Paint the doors and linings, sashes and linings, &c. iron partitions of stalls and bressummer over hay-racks, and all iron-work inside, three times in oil, stone colour, or other common colour, as may be described.

The white lead and materials to be of an unexceptionable kind, and the wood-work to be oil knotted and stopped with putty where necessary, the whole being left in the most workmanlike manner.

General conditions. The following conditions and general observations are to apply, and be attended to, in the proposals for the whole of the works, or for the distinct and separate trades, by the contractor or contractors.

The contracts are to be entered into with the tenders are to be delivered, sealed and directed to the architect, at on or before and are to state a sufficient sum, with a distinct sum for each separate trade, for which the several branches of work will be undertaken, subject to the condition contained in the specification.

The contractor, whether for the whole or separate trades, is to provide all manner of labour, tools, implements, scaffolding, ropes, ladders, materials of every description, carriage and every thing requisite for the completion of the respective works, and is to make good all damage or defects which may be occasioned, whether from carelessness or other cause; the contractor repairing such damages or defects, to charge the expenses by whom it has been occasioned.

The workmen of the different contractors are to attend to give the necessary assistance stipulated for each other in the execution of their work. Each contractor is to clear away from time to time all rubbish occasioned by their respective works.

The drawings are to be equally binding with the specification; and should any thing appear in them which has been omitted to be described, the contractor is to execute the same consistent with the general tenour of the specification, and the whole building is to be left in a complete state, according to the true intent and meaning of the different drawings: and the directions which may be given from time to time by the architect for its strict performance, are to be strictly adhered to.

The architect is to be at full liberty to order the discharge of, or dismiss from the works or premises, any man or men for incompetency or misconduct, and the contractor is not to replace them without the approbation of the architect. It is also to be in the power of the architect to direct such alterations to be made in the work during its progress as may be found expedient; which alterations shall not vitiate or make void the contract, but shall be performed by the contractor according to the directions he may receive; and the value of the same, whether an addition or deduction, is to be ascertained by the said architect, and to be added to or deducted from the amount of the contract, and the award of the architect shall be final.

No allowance will be made to the contractor for any extra or additional work, unless the same shall have been ordered in writing by the architect, and unless an account, or voucher of the said work, is delivered to the architect within three days of its performance.

Should any of the materials, &c. be lost or stolen from the premises, no allowance will be made to the contractor for the same; and should it be deemed necessary at any time to suspend the works, on account of weather or other cause, the architect shall be at full liberty to do so, and no extra charge shall be made on this account by the contractor.

The architect shall have full power to reject any of the materials which he may think unfit for the work, or to cause any part of the work to be altered which is in his opinion unsound or unworkmanlike, and not according to contract, upon three days' notice being given in writing for that purpose by the architect; and in case the contractor shall refuse or delay to rectify the same, or comply with the orders that may be so given him in writing, or refuse or delay to perform all or any part of the work in a proper manner, or in case the works do not proceed with proper despatch, Mr. —— shall have power and full liberty to suspend the further execution of the works by the said contractor, to take it out of his hands, and employ or engage any other workmen to perform and execute the same; in which case the costs and charges thereof shall be paid or allowed to Mr. —— by the contractor, or retained or deducted out of the money which may be then due, or become due, to the contractor, the amount of which shall be valued and decided by the architect, whose award in this and in all other cases shall be final.

The contractor or contractors shall receive the amount of their tender from Mr. —— within one month after the whole of their respective works have been completed, upon producing a certificate from the architect, stating that their respective works have been performed according to contract; or, if desired by them, they shall receive a payment of half the amount of their tender upon producing a certificate from the architect, stating that two-thirds of their respective works have been performed, and the balance within one month after the whole of their respective works have been performed, upon producing a certificate as before stated.

To

Sir,

We, the undersigned, agree to perform the respective works stipulated for each of us, according to the particulars and conditions contained in the foregoing specification, and according to the true intent and meaning of Drawings, (signed also by us at the back,) marked without any reference to the quantities or valuations from which our tenders were made, and for the sums annexed to our signatures.

We also agree, that in case of any works being done at your dwelling, or any other premises, on your account, they shall be done according to the directions, and subject to the valuation of Mr. ——, your architect, and according to the conditions contained in the said specification. Witness our hands day of

			£	s.	d.
Witness to the Signatures, M. N.	A. B.	—Excavator and Bricklayer, Slater and Plasterer	183	14	0
	C. D.	Carpenter and Joiner	190	0	0
	E. F.	Mason	14	15	0
	G. H.	Smith and Iron Founder	43	14	0
	I. J.	Plumber and Glazier	13	8	6
	K. L.	Painter	7	0	0
			£452	11	6

Building. A mass formed by the junction of materials.

When any one intends to build, he should make choice of an architect who is known to be trustworthy and well skilled in his profession. To him he should communicate his ideas with respect to the required number of rooms; the purposes for which those rooms are to be destined; and the total expense at which he wishes the building to be completed. The architect, being thus acquainted with the necessary particulars, proceeds to make out a design, and, having submitted it to, and obtained the approval of, his employer, then makes out a calculation of the expenses. If those expenses exceed the amount proposed to be laid out, the design must be either proportionally reduced in all its dimensions, or such parts as are the least required may be omitted, or the exterior or the apartments may be divested of some of the proposed ornaments, accordingly as either of these be the most agreeable to the wishes of the proprietor: Every thing being thus adjusted, so as to bring the sum within the amount proposed to be laid out, the proprietor should commit the entire management to the architect, who then makes out a specification, (*see the preceding article*,) and selects such masters for the execution of the respective departments as shall appear to him most competent to the undertaking. It is customary for the architect, when he has made out the specification, to submit the several items, together with the drawings, to the respective masters, whom he forthwith requires to furnish him with an estimate of the expense. If the estimate appears reasonable, each master-tradesman enters into a written contract for the due completion of the several works, accordingly as they are described in the specification, and at the sum which he has estimated as a fair remuneration for the time and labour to be consumed. There are, however, some cases, in which, from novelties of execution, no estimate can be made: and, again, there are other cases, which, though peculiarly novel, and not admitting of an estimate previously to the commencement of the work, yet, from consisting of a repetition of the same novelties, allow of it after a very small portion of the work is completed: in such cases, the architect must act accordingly. Again, there are many proprietors whose ideas are ever changing, and who no sooner see a portion of the work completed, than they require to have it altered: under such circumstances, it would be imprudent to contract, and the work should be charged by measure and value, affixing a regular price to every correspondent article, and taking an account of the work pulled down, and the time employed in its demolition. In whatever way the work is to be valued, it is customary in large undertakings to employ a person stationary on the premises, called a *clerk of the works;* to him the architect communicates his full intentions, and gives him authority to superintend the whole of the execution, to keep an account of the workmen's time, to give in weekly reports, and to examine such parts of the work as may be prepared out of the premises.

The preliminary measures necessary to the construction of an edifice are, drawing the plans of the several stories, the elevations of the façades, a longitudinal and transverse section at the least, a horizontal and vertical section of each of the most difficult parts, and a detail of all the mouldings and ornaments at large; from these drawings the specification is drawn out and the expense estimated. It is not, however, an easy task for an architect to furnish all the detail of a building previously to its commencement; but if sufficient time were allowed this might be done, and an estimate of the expense correctly ascertained. For further particulars, the reader is referred to the articles *Architecture, Bricklaying, Masonry, Carpentry, Joinery,* &c. &c.

Building. *In Masonry.* The art of connecting stones together, either with or without cement, so as to form the whole or part of an edifice. It also signifies the mass or body which is formed by the junction of stones with regular surfaces; in which sense it is analogous to masonry, or a piece of masonry. See *Masonry.*

Building act. An act passed by the legislature, containing certain restrictions or regulations for the erecting of houses within the cities of London and Westminster, the weekly bills of mortality, the parishes of St. Mary-la-bonne, Paddington, St. Pancras, and St. Luke, Chelsea. This act was passed in the 14th Geo. 3. cap. 78. and a faithful abstract of it has been given under the article *Bricklayer.*

Building of beams. The uniting of several pieces of timber together, by means of bolts, so as to form a beam of a greater length and thickness than could possibly be obtained from a single piece of timber. Beams which have been thus built, and judiciously strapped across the exterior sides, are much stronger than such as are scarfed, nor is so much timber wasted in their construction. Many advantages may be derived from the building of beams; for independently of their being much stronger, and requiring less waste of timber in their construction than such as are scarfed, ribs may be built for vaulted roofs that, by proper attention to the degree of curvature, will require no trussing. See the articles *Rib and Scarfing.*

Buleuteria. *In Grecian Antiquity.* Public halls at Athens, where companies of tradesmen assembled to deliberate on commercial purposes.

Bulker. A term in Lincolnshire for a beam or rafter.

Bullen nails. Nails with round heads and short shanks, tinned and lackered. These nails are principally used in the hangings of rooms.

Bullock's-eye. *Œil de Bœuf.* A little skylight in the covering or roof, designed to illumine a granary or the like.

Bullock-sheds. *In Rural Economy.* The houses in which bullocks are kept while feeding.

In the construction of these buildings attention should always be had to their being well aired, to the facility of feeding and cleaning the animals in them, and to their being kept clean and dry by their having suitable drains and conveniences for urine and dung. In the rural economy of Norfolk, Mr. Marshall remarks, that a bullock-house there consists of a centre building, 36 feet long, 19 feet wide, and about 11 feet high, with a pair of wide folding doors at each end, and a lean-to on each side the whole length of the building, and 11 feet wide. The centre building is the turnip-house; the lean-to sheds for bullocks, which stand with their heads towards, or rather in, the turnip-house, from which they are parted by a range of mangers only, having the full freedom of breathing in its spacious area; by opening the doors at each end, a sufficient degree of air and coolness may be given in hot weather, while behind, the eaves of the sheds are brought down to within five feet of the ground, and are boarded with rough boards, except an opening at each end for the bullocks to creep in at, to prevent too great a coldness in severe weather; thus preserving a due temperature. The shed of these dimensions, thus constructed, holds twenty bullocks, ten on each side, fastened by the neck, with chains, swivels, and rings, playing freely upon posts seven feet high. At each corner of the turnip-house is a triangular bin, for containing the topped and tailed turnips or other provisions.

In autumn, it is further observed, the entire building is sometimes used as a temporary barn for buck wheat, peas, &c. and in summer the centre part is an excellent waggon-shed; had the doors been made a foot and a half higher, it is suggested that it would have been an admirable refuge for loads of corn or hay in a showery harvest. The main building is covered with reed, the lean-toes with tiles. And in the rural economy of Gloucestershire, the same writer observes, that each bullock has a house and yard to himself, in which he goes loose, occupying them by turns, as appetite or amusement directs him, having a manger and a drinking trough to go to at pleasure.

The construction of these, however, vary in the minutiæ; the water trough, for instance, is sometimes placed by the manger, in the hovel or shed, sometimes in the open pen; other less noticeable variations may be seen in different buildings. But the plan and dimensions which at present seem to stand in the highest esteem, and on which several erections of this nature have been made within the last fifteen or twenty years, are the following: the building, 15 to 15½ feet wide within, and of a length proportioned to the number of stalls required; the height of the plates 5 feet to 6 feet 4 inches, supported on the side by the north or east by close walling; on that to the south or west by posts, set on stone pedestals; the gables walling, the covering plain tiles, on a single pitch roof; against the back wall is a gangway, 3½ to 4 feet wide, formed by a length of mangers, 3 feet to 3½ feet wide, from out to out, the top narrowing to about 15 inches within at the bottom; the perpendicular depth 14 to 15 inches; the height of the top rail from the ground about 2 feet 9 inches; the materials 2-inch plank stayed and supported by posts and cross-pieces, and stiffened by strong top rails; the dimensions of the area of the covered stalls about 8 feet 3 inches square; of the open pens the same. The partitions between the stalls are of broad nails, passing from the outer pillars to similar posts, rising on the inner or stall side of the manger, and steadied at the top by slender beams, reaching across the building, each stall, or each partition, having a beam and pair of principals. The partitions of the pens are gates, reaching from the pillars to the boundary wall, and likewise from pillar to pillar; when they are fixed in that situation each bullock has his stall and his little yard; when in this, each is shut up in his stall: the yard forms a lane or drift-way for taking in or turning out any individual. The boundary wall of the pens is about 4 feet high, coped with blocks of copper dross; on the outer side of it is a receptacle of manure, on the inner a range of water troughs, with a channel of communication for the convenience of filling them. The materials of the troughs are stone, of the channel gutter bricks, covered with slates. These stone troughs, which are about 14 inches by 2 feet 6, have a conveniency in their construction which is entitled to notice; instead of the sides and ends being all of them pecked down to an angle, square with the bottom, one of the ends is left bevelling sloping, making a very obtuse angle with the bottom; this simple variation makes them very easy to be cleaned, either with the shovel or the broom.

The floor is paved with hard-burnt bricks, laid edgwise in mortar, being formed with a deep descent from the wall to a channel, from 3 to 4 feet from it, and with a gentle fall from the manger to the same channel, which becomes the general drain for rain-water and urine. At one end of the pens is a pump (where a natural rill cannot be had) for supplying the troughs of water, and at the other a stack of stubble for litter, which is used in the stall only, the yard being left unlittered. At one end of the building is a cake-house, at the other a rick-yard, with a door at each end of the gangway to receive the hay and the cake.

In some instances he has seen a double range of stalls on this plan, the area between them being the common receptacle for the dung. When a number of stalls, as twenty or thirty, are required, their arrangement brings them within a convenient compass, and the two ranges, with a proper aspect, become shelter to each other. Beside these loose stalls, there are others built nearly on the same plan, but without gates, and on a somewhat larger scale, in which the cattle are fastened to the manger, or the partition posts, with a long chain, which gives them liberty to rub and lick themselves, and move about in their stalls. In this case a water trough is generally placed at the end of every second partition, level with the manger, and with a general pipe of communication to fill them, each trough supplying two bullocks. This plan, he observes, lessens the expense in some degree, and prevents the bullocks from fouling their mangers. In the Cotswold hills, he remarks that each bullock has different troughs, a small one for corn, a larger one for hay, with a water trough which runs the whole length of the shed, and is covered by a board, each bullock having a hole to drink at. There are various other constructions of sheds for this use, which will be more particularly described under their proper heads. See *Cattle Sheds and Feeding Houses.*

Bullock-stalls. The parts that are partitioned off in the sheds, in which the bullocks stand to eat their food. They should always be made sufficiently roomy. See *Cattle Sheds.*

Bulwark. *In Ancient Fortifications.* Nearly the same with bastion in the modern. See *Rampart and Torus.*

Bundle-pillar. *In Gothic Architecture.* A column consisting of a number of small pillars round its circumference.

Buonarotti, Michael Angelo. See *Bonarrotti.*

Burca. A term among the Turks for the rich covering of the door of the house at Mecca. It is 10 feet long and 5 feet wide; and there are several figures and Arabic letters on it, richly embroidered in gold, on a ground of red and green. This is carried round in their solemn processions, and is often made to stop that the people may touch it.

Burgward, burgwardus, or bugwardium. *In Middle Age Writers.* The same with bulwark. The name is also extended to the town, and even to the country, about such a fortress.

Bursa. *In Middle Age Writers.* A little college or hall in a university for the residence of students.

Burse. *In Matters of Commerce.* Denotes a public edifice for the assembly of merchants and traders; and is used in the same sense as the more modern appellation, Exchange.

Buschetto da Dulichio. A celebrated Grecian architect, born in the isle of Dulichio, and employed in 1016, by the republic of Pisa, in building and ornamenting their dome or cathedral church; which he enriched with many marble columns, and which has ever since been reckoned one of the most sumptuous edifices in Italy. He died at Pisa, where a monument was erected to his memory, bearing an inscription which intimates his extraordinary knowledge of the mechanic powers. His disciples were numerous, and he is regarded as the principal founder of modern architectural science in Italy.

Bust, or busto. *In Sculpture.* That portion of the human figure, which comprises the head, neck, breast, and shoulders. By the Italians this term is applied to the human figure as low as the hips, with or without the head and arms; which definition agrees with that species of sculpture which represents the portraits of illustrious Romans, either entirely round and mounted on pedestals, or in alto relievo on the sides of sarcophagi or other sepulchral monuments. The etymology of the Italian busto most probably is from the Latin, *bustum.*

Bustum. A figurative expression among the Romans for any kind of tomb. The bustum, in the Campus Martius, was a structure whereon the bodies of the emperor Augustus and his successors were burnt. It was built of white stone, surrounded with an iron palisade, and planted within side with alder trees. The word bustum also denoted the hearth, or place of an altar where the fire was kindled.

But-hinges. Hinges employed in the hanging of doors, shutters, casements, &c. See *Hinges.*

Butments, or abutments. Supports or props, by which the feet of arches, or any bodies pressing in an oblique direction to the horizon, are sustained in their places. See *Abutment and Bridge.*

Butment-cheeks. The two solid parts on each side of a mortise. The thickness of each cheek is commonly equal to the thickness of the mortise; but circumstances sometimes arise which require them to be of a different thickness.

Butt-end of a piece of timber. That end of a plank which was nearest to the root of the tree.

Butt-joint. In *Hand-railing.* A joint at right angles to the curve of the rail. See *Hand-railing.*

Buttery. A store-room for provisions.

Butting-joint. A joint formed by the surfaces of two pieces of wood, the surface of the one piece being parallel with the fibres, and that of the other, either in the same, or in an oblique direction with them. The joints which the struts and braces form with the truss-posts, in carpentry, are of this description.

Button. A small piece of wood or metal, turning on a centre, for fastening a door, window, or other closure. The button is generally made to turn on a nail, which nail is consequently made round, and has a smooth head.

Button of a lock. Denotes a round head serving to move the bolt.

Buttress. A mass of masonry, or brickwork, serving to support the side of a wall that is of very great height, or that is pressed on the opposite side by an adventitious force, as a bank of earth, or body of water. In those structures improperly called gothic, buttresses are placed around the exterior sides of the building, one in the intermediate space between every two windows, and one or two at each of the angles, in order to support the vaulting. In gothic, or pointed architecture, two kinds of buttresses are used; the one, formed of vertical planes, and attached to the walls, is called *pillared-buttresses;* the other, which rises from the pillared-buttresses upon the sides of the aisle with an arch-formed intrados, and sloping extrados, or top, is called *flying-buttresses,* or *arc-boutants.* See *Arc-boutants, Pointed Architecture,* &c.

C.

Caaba. A square stone edifice in the temple of Mecca; being the part principally reverenced by the Mahometans, and to which they always direct themselves in prayer. The believers of the Mahometan faith attribute the erection of this building to Abraham and his son Ishmael.

The word is Arabic, *caaba* or *caabah,* a denomination which some suppose to have been given to this building on account of its height, which surpasses that of the other buildings in Mecca; but others, with a greater degree of probability, derive the name from the quadrangular form of the structure.

This building is so ancient, that its original use and the name of the founder are lost in idle traditions. The Mahometans affirm, that it is almost coeval with the world, and they pretend that Adam, after his expulsion from Paradise, supplicated divine permission to erect a building like what he had seen there, called "Beit al Mamâr," or the frequented house, and "Al Dorah," towards which he might direct his prayers, and which he might compass, as the angels do the celestial one. Upon which God let down a representation of that house in curtains of light, and set it in Mecca, perpendicularly under its original, ordering the patriarch to turn towards it when he prayed, and to compass it by way of devotion. After Adam's death, they say that his son Seth built a house in the same form, of stones and clay, which, being destroyed by the deluge, was rebuilt by Abraham and Ishmael at the command of God, in the place where the former had stood, and after the same model. Notwithstanding the absurdity of these traditions, it is not improbable that it was erected by some of the immediate descendants of Ishmael. It is most probable that the caaba was primarily designed for religious purposes; and it is certain that it was held in the highest veneration long before the birth of Mahomet. Having undergone several reparations, it was, a few years after his birth, rebuilt on the same foundations by the tribe of Koreish, who had acquired the custody of it, either by fraud or force. It was afterwards repaired by Abdallah Ebn Zobeir, the caliph of Mecca; and again rebuilt by Zusof, surnamed Al Hejâj, in the seventy-fourth year of the Hegira, with some alterations, in which form it now remains.

The length of the caaba, from north to south, is 24 cubits; its breadth, from east to west, 23 cubits; and its height 27 cubits. The door which is on the east side, is raised about 4 cubits from the ground; and the floor is level with the door. In the corner, next this door, is the "black stone," so celebrated amongst the Mahometans. This stone is set in silver, and fixed in the south-east corner of the building, or that which looks towards Basra, about two cubits and one-third, or seven spans from the ground. The Moslems pretend that it was one of the precious stones of Paradise, and that it fell down to the earth with Adam, and being taken up again, or otherwise preserved, at the deluge, was, by the angel Gabriel, afterwards brought back to Abraham, when he was building the caaba. Be this as it may, the "black stone" is held in very high estimation by the Mahometans, and is kissed by the pilgrims with great devotion, some of whom call it "the right hand of God on earth."

The caaba has a double roof, supported within by three octangular pillars of aloes wood, between which are suspended, on a bar of iron, some silver lamps. The outside is covered with rich black damask, adorned with an embroidered band of gold, which is changed every year, and is provided by the Turkish emperors. At some distance the caaba is surrounded, but not entirely, by a circular enclosure of pillars, joined towards the bottom by a low balustrade, and towards the top by bars of silver. Without this enclosure, on the south-west and north side of the caaba, are three buildings; which are the oratories, or places where three of the orthodox sects assemble to perform their devotion: and towards the south-east stands the edifice which covers the well

Zemzem, the treasury, and the cupola of Al Abbas. All these buildings are enclosed, at a considerable distance, by a magnificent piazza, or square colonnade, resembling the Royal Exchange of London, but much larger, covered with small domes and cupolas, from the four corners of which rise as many minarets or steeples, with double galleries, and adorned with gilded spires and crescents, as are the cupolas which cover the piazzas. Between the pillars of both enclosures hang a great number of lamps, which are constantly lighted at night. The first foundations of this outward enclosure were laid by Omar, the second caliph, who built no more than a low wall, to prevent the court of the caaba from being encroached on by private buildings; but the structure has been since raised, by the liberality of many of the succeeding princes and great men, to its present lustre.

Cabin, or cabbin. A room, or an apartment, in a ship, where an officer usually resides. The same term is also applied to the huts and cottages of poor people, and those of savages. The cabins of the Indians of Virginia are about 9 or 10 feet high. They are made by fixing poles into the ground, and bringing the tops of them one within another, and so tying them together, as to leave a hole in the middle of the top of the cabin, for the egress of smoke. To preserve themselves from the inclemencies of the weather, the Indians cover the outside of their cabins with bark, and cast up banks of earth round the interior, to serve as stools and beds.

Cabinet, or cabbinet. The most retired place in a building, set apart for writing, studying, or preserving any thing that is valuable. A complete apartment consists of a hall, an antechamber, a chamber, and a cabinet, with a gallery on one side.

Sometimes the word cabinet is used to particularize that place at the end of a gallery, wherein are preserved the pictures of the best masters, conveniently arranged, and accompanied with busts and figures of marble and bronze, with other curiosities.

The same term is also applied to a highly ornamented kind of buffet or chest of drawers, set apart for the preservation of things of value, and used partly as a decoration of a chamber.

Cabinet. *In Gardening*. A little insulated building, or kind of summer-house, built in some agreeable form, and open on all sides; serving as a place of retirement, and to take the fresh air under cover.

The plan of the cabinet is either square, circular, or polygonal, after the manner of a saloon.

Cable. A moulding in the lower part of a fluted column, representing a rope, or rush, lying in the fluting; which has given to columns of this description the term *cable-fluted.*

This moulding is of a convex circular section, rising from the concave surface of the flute, so that its most prominent part may be in a surface with the fillet on each side of the flute. See *Column and Flutes.*

Cabled column. See *Column.*

Cabled flutes. Such flutes as are filled with cables.

Cabling. The filling of the flutes of columns with cables, or the cables so disposed. See *Flutes.*

Caduceus. A rod or sceptre entwined by two winged serpents, and carried by Mercury, as an attribute of his quality and office.

Caer. *In British Antiquity.* A term which, like the Saxon *chester*, denotes castle, and is prefixed to the names of places fortified by the Romans.

Cage. *In Carpentry.* An outer work of timber, enclosing another within it. In this sense, the cage of a staircase is the wooden sides, or walls, which enclose it.

Caisson. Large chests, framed of strong timbers, and made water tight, sometimes used in large and deep rivers for building the piers of bridges. The bottom of the caisson is composed of a strong grating of timber, and is so contrived that it can be detached from the sides when requisite. In this mode of bridge-building, the ground where the pier is to be sunk is first excavated and levelled; and the caisson is then launched, and floated to the spot, and sunk. The building of the pier then commences within it, and is carried up above, or nearly to a level with the water; when the sides of the caisson being detached, the bottom, with the pier upon it, is allowed to remain as a foundation.

The most considerable work, that has come to our knowledge, in which caissons have been used, is that of the building of Westminster bridge: of these, therefore, a particular description may be acceptable. Each of the caissons contained one hundred and fifty loads of fir-timber, and was of more tonnage than a man of war of 40 guns; their size was nearly 80 feet from point to point, and 30 feet in breadth; the sides, which were 10 feet in height, were formed of timbers laid horizontally over one another, pinned with oak trunnels, and framed together at all the corners, except the salient angles, where they were secured by proper iron-work, which, being unscrewed, would permit the sides of the caisson, had it been necessary, to divide into two parts. These sides were planked across the timbers inside and outside with 3-inch planks, in a vertical position. The thickness of the sides was 18 inches at the bottom, and 15 inches at top; and in order to strengthen them the more, every angle, except the two points, had three oaken knee-timbers, properly bolted and secured. These sides, when finished, were fastened to the bottom, or grating, by 28 pieces of timber on the outside and 18 pieces within, called straps, about 6 inches broad, and about 3 inches thick, reaching and lapping over the tops of the sides: the lower part of these straps were dovetailed to the outer curb of the grating, and kept in their places by iron wedges. The purpose of these straps and wedges was, that when the pier was built up sufficiently high above low-water mark, to render the caisson no longer necessary for the masons to work in, the wedges could be drawn up, so as to give liberty to clear the straps from the mortises; in consequence of which, the sides arose by their own buoyancy, and left the grating under the foundation of the pier.

The pressure of the water upon the sides of the caisson was resisted by means of a ground timber or ribbon, 14 inches wide, and 7 inches thick, pinned upon the upper row of timbers of the grating, and the tops of the sides were secured by a sufficient number of beams laid across, which also served to support a floor, on which the labourers stood to hoist the stones out of the lighters, and to lower them into the caisson.

The caisson was also provided

with a sluice to admit the water. The method of working was as follows: a pit being dug and levelled in the proper situation for the pier, of the same shape as the caisson, and about 5 feet wide all round, the caisson was brought to its position, a few of the lower courses of the pier built in it, and sunk once or twice to prove the level of the foundation; then being finally fixed, the masons worked in the usual methods of tidework. About two hours before low water, the sluice of the caisson, which had been kept open till then, lest the water, flowing to many more feet on the outside than the inside, should float the caisson and all the stonework out of its true place, was shut down, and, without waiting for the lowest ebb of the tide, the water was pumped sufficiently low to admit the masons to set and cramp the stone-work of the succeeding courses; then, when the tide had risen to a considerable height, the sluice was opened again, and the water admitted: and as, with a view to save unnecessary expense, the caisson was purposely built but 16 feet high, the high tides flowed several feet above the sides, but without any damage or inconvenience to the works. In this manner the work proceeded till the pier rose to the surface of the caisson, when the sides were floated away to serve the same purpose at another pier. *Labelye's Description of Westminster Bridge.*

Calcareous cement. See *Cements.*

Caldarium. A brazen vessel, or cistern, in ancient baths, placed in the hypocaustum, full of hot water, to be drawn thence into the *piscina*, or bath, to give it the necessary degree of heat. In this sense, the caldarium stood contradistinguished from the *tepidarium* and *frigidarium.*

Caldarium. A close vaulted room, in which people were brought to a profuse sweat by dry hot fumes. In this sense, caldarium was the same with what was otherwise denominated *vaporarium, sudatorium, and laconium;* and in the Greek baths, *hypocaustum.*

Calendario, Philip. A celebrated architect and sculptor of Venice, who flourished in the time of Martin Faletri, doge of that republic, in 1354. He constructed those beautiful porticoes, supported by marble columns, which surround the place of St. Mark. By these works he established both his fame and fortune.

Calf-pen. A place in which calves are confined for the practice of fattening them.

The calf-pen is most commonly annexed to the cow-house, which is a plan that cannot be recommended, as the cries of the calf have an influence on the cow, keeping her in a restless, agitated state, preventing her from feeding well, and from giving that quantity of milk which she would otherwise furnish.

The principal thing to be observed in the construction of calf-pens is the laying of the floor, which should be made of laths or spars, about 2 inches broad, laid at the distance of an inch from each other, upon joists, so as to make the floor above 1, 2, or 3 feet from the ground, as the situation will admit. This not only keeps them dry, by allowing the moisture to pass immediately away, but has the advantage of admitting fresh air below the bedding, and thereby preventing that unwholesome, disagreeable smell too often found among calves.

Stalls, or divisions, are but seldom made in calf-pens; it would, however, be much better to keep them separated, as by that means they will be more easily fed, and much less liable to accidents. Partitions, about 3 feet high, of thin deal, nailed on small posts, might be so contrived as to be movable at pleasure, to increase or diminish the stall if necessary, according to the age and size of the calf. This may be done as represented in plate *M* 17, fig. 1, which is the ground plan of a double calf-pen for ten calves: *a* is the door; *b*, the passage betwixt the pens; *c*, *c*, *c*, &c. are the pens, showing the situation of the partitions; *d*, *d*, *d*, *d*, are four joists, in which are several holes, as shown on the plan, for receiving iron pins at the bottom of the partitions, to keep them in their places; *e* is a window or door, besides which there should be some other windows or air-holes, as high up as possible. If it be thought unnecessary to make the partitions, there might be a small round trough, in a circular frame, fixed in the corner of each pen, as at *f*, for holding the milk, and a door in the next adjoining corner. The troughs should be round, that the calves may not hurt themselves upon them, which probably they might do on the angles, if the troughs were square. Fig. 2 is a section of these pens, in which *r*, *r*, show the position of the racks. The advantages of this kind of calf-pens are, that the calves are all kept separate in a small compass, and cannot hurt each other, as the stronger ones sometimes do the weaker when confined promiscuously; their food also may be much more easily and equally distributed when not suckled.

To the above description of Mr. Beatson we may add, that Mr. Marshall, speaking of the rural economy of Gloucestershire, observes, that the house or roomstead, in which the calf-pen is placed, is about 12 feet by 8; 4 feet of its width being occupied by the stage, and 1 foot by a trough placed in its front, leaving 3 feet as a gangway, into the middle of which the door opens. The floor of the stage is formed of laths, about 2 inches square, lying lengthwise of the stage, and 1 inch asunder. The front fence is made of staves, an inch and a half in diameter, 9 inches from middle to middle, and 3 feet high, entered at the bottom into the front bearer of the floor, (from which cross-joists pass into the back wall,) and steadied at the top by a rail, which, as well as the bottom piece, is entered at each end into the end wall. The holes in the upper rail are wide enough to permit the staves to be lifted up and taken out, to give admission to the calves; one of which is fastened to every second staff, by means of two rings of iron, joined by a swivel; one ring playing upon the staff, the other receiving a broad leathern collar, which is buckled round the neck of the calf.

Caliber, or calliper. The diameter or greatest extent of any round body. It also denotes the width of the bone of a piece of ordnance.

Caliber compasses. Compasses with arched legs, to take the diameter of concave or convex bodies.

Caliducts. This word is derived from *calor*, heat, and *duco*, I lead, and signifies a kind of pipes or canals, disposed along the walls of houses and apartments, used by the ancients, for the conveyance of heat from one common furnace to the several remote parts of the house.

Calliber, or callipér. See *Caliber*.

Callicrates. An Athenian architect and sculptor, who lived about 472 years before the birth of Christ. He is said to have engraved some of Homer's verses on a grain of millet, and to have made an ivory chariot which might be concealed under the wing of a fly, and an ant of ivory in which all the members were distinct. Ælian, however, justly censures him for employing his talents in performances so trivial and useless, and yet so difficult.

Callimachus. A celebrated Corinthian architect, painter, and sculptor, who flourished about 540 years before Christ. He is supposed to have been the inventor of the corinthian order, and he made a golden lamp for the temple of Minerva, at Athens, which he furnished with a wick of Asbestos, that it might burn without wasting.

Calotte. A concavity or depressure in the form of a cup or niche, lathed and plastered, to diminish the height of a chapel, cabinet, alcove, or the like, which otherwise would be too high for the breadth.

Camarosis. An elevation terminating with an arched or vaulted head.

Camber. An arch on the top of an aperture, or on the top of a beam; hence camber-windows.

Camber-beam. A piece of timber cut with an obtuse angle on the upper edge, so as to form a declivity on each side from the middle of their length. Beams of this description are used in truncated roofs, being covered with boards, and the boards covered with lead, to discharge the rain-water towards each end of the platform.

Camerated. The same as arched.

Cames. Small slender rods of cast lead, 12 or 14 inches long, of which the glaziers, by drawing them separately through a vice, make their turned lead.

Camp ceiling. See *Ceiling*.

Campana. The body of the corinthian capital, otherwise, from its figure, called the vase or bell.

Campanile. From the Italian *campano*, which signifies a bell. A tower allotted for bells. In Italy it is customary to hang the bells in towers that are separate from the churches, and not to hang them in steeples upon the churches as is practised in England.

Some of the campaniles, or belfries, of Italy, are very lofty and magnificent; and of these, that of Cremona is the most celebrated, being 395 feet in height. This structure consists of a square tower, which rises 262 feet, surmounted by two octagonal stories, open to the air, and ornamented with columns; a conical shaft and cross terminate the elevation. The campanile of Florence, built from the designs of Giotto, though exhibiting vestiges of a barbarous taste, must still be admired for its richness and the superiority of the workmanship. It is a tower of 267 feet high, on a base of 45 feet square.

The great elevation of these buildings, combined with the narrowness of their basis, has occasioned considerable settlements in many of them; the most remarkable of these is that of Torre Pendente at Pisa. It is of a cylindrical form, surrounded with eight stories of columns placed over one another, each having its entablature. These columns are of marble, and seem to have been taken from the ruins of ancient edifices. Each column carries the springing of two arches; and there is an open gallery between the columns and the circular wall of the tower. The height of the last story of columns, which forms the belfry, retires from the general line of elevation: the height to the platform is 150 feet; and a plumb-line lowered thence to the ground falls nearly 13 feet beyond the base of the building.

Canal. A duct or pipe, through which any fluid is conveyed; for example, the canal of an aqueduct is that part through which the water passes. In ancient aqueducts the canals were lined with a coat of mastic.

Canal. This word is sometimes used for the flutings of a column or pilaster.

Canal of the volute. In the ionic capital there is a spiral channel, or sinking on the face, commencing at the eye, and expanding in width until the whole number of revolutions are completed; this is called the *canal*. In the Athenian temples of Minerva Polius and Erechtheus, (*see plate, A* 12), are several of these canals, commencing and ending in the manner above described.

Canal of the larmier. A channel, or groove, recessed on the soffit of the larmier upwards, to prevent the rain-water from running down the bed or lower part of the cornice. See *Beak*.

Canardiere. A small turret, guerite, or sentry-box, made either of wood or stone, and sometimes erected at the salient angles of works to serve as a shelter for a sentinel. Formerly canardieres were constructed on castles to secure the warriors from danger while they discharged their missiles.

Cancelli. Latticed windows, or such as are made with cross bars of wood or iron: also the balusters or rails which compass a court of justice, communion-table, or the like.

Candelabrum. Stands, or supports, on which the ancients placed their lamps. Candelabra were made in a variety of shapes, and much taste and elegance were displayed in their construction.

Cano, Alonso. A distinguished individual who, from excelling in the three arts of architecture, sculpture, and painting, was called the Michael Angelo of Spain. He was born in 1600, at the city of Grenada. Having studied the principles of architecture under his father, an eminent architect of his native city, he next directed his attention to sculpture, as a disciple of Pacheco of Seville, and afterwards applied himself to the art of painting in the academy of Juan del Castillo, the painter, in the same city. Besides many fine pieces which he executed for the public edifices of Seville, he also practised sculpture, and made two colossal figures of St. Peter and St. Paul, of such peculiar excellence that the Flemish artists are said to have visited Seville in order to have an opportunity of copying them. Claiming noble birth, and possessing a high spirit, his first productions were gratuitous. In consequence of a quarrel with Sebastian de Llanas, an eminent painter, which terminated in a duel, he was obliged to quit Seville; and in the suite of the Count-duke Olivares, as well as under his protection, he went to Madrid, where he was soon appointed first royal architect, king's painter, and instructor to the prince, Don Balthasar Carlos.

In this situation he acquired distinguished reputation as an architect, sculptor, and painter. His fame, however, excited jealousy and envy, and he was charged with plagiarism in the composition of his pieces. But another circumstance occurred which was much more injurious to his prosperity. Upon his returning home one evening, he found his wife murdered, and his house pillaged, and an Italian journeyman missing. The magistrates, discovering that Cano had been jealous of this Italian, and that he was attached to another woman, charged him with the murder, which induced him to make a speedy retreat. He fled for refuge to Valencia, but was soon betrayed by the practice of his art: he then sought an asylum in a Carthusian convent near that city; but being deterred, by the dread of its austerities, from taking the order, he returned to Madrid, where he was apprehended, and delivered to the torture in order to extract a confession. Having endured the rack without self-crimination, he was again taken into favour by the king; and with a view to his future security, he obtained the clerical office of residentiary of Grenada. In this situation he enriched the churches of Grenada and Malaga with many paintings and sculptures. But having been refused the payment of 100 pistoles by a counsellor of Grenada for an image of St. Anthony of Padua, he dashed the saint in pieces on the floor of his academy. This sally of fury induced the chapter of Grenada to suspend him from his function; but he was restored by the king, on the condition of finishing a magnificent crucifix, which the king had bespoken, but which he had long neglected. From this time, he led a life of charity and devotion; and when destitute of money, he supplied the wants of a beggar by sketching a drawing upon paper, and directing him how to dispose of it. The violence of his temper was still unsubdued; and even in his last moments he could not be prevailed upon to make use of a crucifix which was presented to him for adoration, because it was such a wretched piece of workmanship, that he could not bear the sight of it. Cano died in the year 1676, at the age of seventy-six.

Canopy. A magnificent covering for an altar, throne, tribunal, pulpit, chair, or the like. See *Baldachin*. Also the label or projecting moulding that surrounds the arches and heads of gothic niches.

Cant. An external angle, or corner, of a building.

Cant. A term among carpenters, signifying to turn a piece of timber which has been brought in the wrong way for their work.

Cant-moulding. A moulding with a bevelled surface. See *Moulding*.

Canted column. See *Column*.

Cantaliver. Blocks of wood or iron, which are placed at regular distances, projecting at right angles from the surface of a wall, to support the eaves of a house, or the upper mouldings of a cornice. Cantaliver is, therefore, essentially the same with modillion; but the latter word is confined to the description of regular architecture, while the former has a general and trivial use.

Cantharus. A fountain or cistern in the middle of the atrium before the ancient churches, wherein persons washed their hands and faces before they entered.

The cantharus of a fountain, among the Romans, was the part or apparatus out of which the water issued. It was made in divers forms, sometimes in that of a shell, at other times, in that of an animal, &c.

CANTHERIS, OR CANTERII. Beams of wood, in the framework of a roof, extending from the ridge to the eaves; corresponding to the rafters of a modern roof. The word canterii was also applied to mean two inclining reeds, fixed in the ground, some distance asunder, and meeting at the top, for the support of vines.

CANTING. The cutting away a part of an angular body at one of its angles, that the section may form a parallelogram, whose edges are parallel from the intersection of the adjoining planes.

CANTING STAIRS. See *Stairs*.

CANTONED. When the angles of a building are adorned with columns, pilasters, rustic quoins, or any thing which projects beyond the naked of the wall, it is called a *cantoned building*.

CANTONED COLUMNS. See *Columns*.

CAP. *In Joinery*. The uppermost part of an assemblage of parts, or that which crowns the whole. In this sense, the term is applied to the capital of a column, cornice of a door, &c. &c.

CAPACITY. *In Geometry*. The solid content of any body.

CAPEDUNCULA. Vessels wherein the ancient Romans preserved the sacred fire of Vesta.

CAPITAL. From the Italian *capitello*, or Latin *caput*, signifying *head*; so that the etymology of this word defines its meaning, the capital being the head of a column.

The capitals used in the architecture of the Greeks, though with numberless minute variations of ornaments and proportions, arrange themselves into three general classes, and offer the most obvious distinction between the orders. In this style also it is easy to distinguish between those parts which have their use and origin in the original type of that wooden construction, from which Grecian architecture derived, and those which are merely ornaments and accessaries. Considering columns in their origin as cylindrical wooden posts, the abacus, which is a square tile or tablet, has an evident use in sheltering and protecting the upper part of the column by its projection, and also by giving a broader bed and more convenient form for the placing of the architrave. The abacus, therefore, may be regarded as the original capital, which is most conspicuous in that order which bears the marks of the highest antiquity, attenuated and altered in succeeding orders and succeeding ages, but never omitted either in the purity of Grecian architecture or its deteriorated imitations.

In all the orders, an astragal and fillet, or one or three channels, separate the capital from the shaft; and these are always considered as part of the column.

The doric capital, which preserves more of the primitive type than any other, is extremely plain, but its simplicity is not without beauty. It consists of a broad and massy abacus, an ovolo under the abacus, from three to five fillets under the ovolo, and under these a neck called the frieze of the capital.

In the ionic capital there is great invention and a particular character displayed; indeed, so much so, that it never fails to distinguish itself, even on the most slight and careless observation. It consists of a small and moulded abacus, below which depend to the right and left two spiral volutes; it has also an echinus, which is not unfrequently enriched, and a bead.

The corinthian capital is most richly ornamented, and differs extremely from the others. In this the abacus is hollowed, forming a quadrilateral figure with concave sides, the angles of which are generally truncated. Sometimes the abacus is enriched, but more frequently ornamented with a flower in the middle. Below the abacus, the capital has the form of a vase or bell, surrounded with two tier of leaves; which, being selected from the most beautiful of the vegetable creation, give it an easy and fine projection. Under each angle of the abacus springs a volute; and under the flower in the centre of the abacus there are caulicoli. The ancients, however, sometimes varied the ornament in the centre of the abacus: an example of this kind was in the porch of Septimius, where, instead of a flower, there was an eagle holding a thunderbolt.

To the capitals above enumerated, in which are displayed so much of Grecian elegance, the Romans have added two others, the tuscan and the composite.

With regard to the tuscan capital, there are no authenticated remains of the order, and the precepts of Vitruvius on this head are so very obscure, that the modern compilers of systems of architecture have of course varied exceedingly in their designs; the order, therefore, that passes under this name, must be regarded rather as a modern than an ancient invention. It has been made to differ from the modern doric, by an air of poverty and rudeness, by the suppression of parts and mouldings. But though the tuscan capital is plain and simple in the highest degree, it well becomes that column whose character is strength.

As the tuscan capital is of all capitals the plainest, so is the composite capital the most elaborately finished. It is, as its name imports, a composed order, formed by an union of the ionic and corinthian, and never appears to have been admitted by the ancients to be a separate order; it consists of a vase or bell, a first and second row of leaves, with some small shoots, a fillet, astragal, ovolo, four volutes, and a hollowed abacus with a flower in its centre.

From the remains of Egyptian antiquity, it appears that the architects, confined to the severest simplicity in the general form of their buildings and principles of construction, acknowledged no given rules or orders of architecture for the proportions and ornaments of inferior members. Accordingly, we find an infinite variety of capitals, many of them possessing great richness of decoration and elegance of outline. The ornaments are in general accurate imitations of the natural productions of the country, such as the lotus, the reed, or the palm. The temples of the ancient inhabitants of Hindostan, works of dateless antiquity, present many capitals of extraordinary form and composition. In some of these we find represented the figures of elephants and horses, apparently couching under the weight of the ceiling. Capitals very similar in ideas to these are also found in the ruins of Persepolis: they are composed of horses and camels.

As Roman architecture sunk

into the degraded and barbarous style, known in this country by the name of Saxon and Norman, which was finally superseded by the mode commonly called Gothic, ancient rules were forgotten or despised, ornaments were abandoned to the caprice of the carver, and an endless variety of capitals were produced, more or less happy according to individual taste or barbarism. Variety, indeed, seems to have been the governing principle of decoration, and was pursued to an unmeaning excess, in contempt of symmetry, propriety, and congruity. (See Supplement.)

Capital, angular. See *Angular Capital.*

Capital of a baluster. One similar to that of the tuscan or doric order.

Capital of a lantern. The covering which terminates the lantern of a dome, either in the figure of a bell, as that of the Sorbonne, or of a cupola or a spiral, as that of the church of Sapienza at Rome.

Capital of a triglyph. The projecting band above the plain vertical area or face. In the Grecian doric, the capital of the triglyph projects only a short distance, and is not returned on the flanks, except at the angular triglyphs, and this only upon each face of the building: in the Roman doric, it has a greater projection, and is returned with the same projection on the flanks as in the face.

Capitol. A celebrated rock, or hill, at Rome, whereon stood many ancient edifices. It derived its name from a man's head being found there while digging the foundations for the temple of Jupiter.

The capitol was anciently both a fortress and a sanctuary. A fortress surrounded with precipices, bidding defiance to all the means of attack employed in ancient times: a sanctuary crowded with altars and temples, the repository of the fatal oracles, the seat of the tutelar deities of the empire. Romulus began the grand work, by erecting the temple of Jupiter Feretrius; Tarquinius Priscus, Servius Tullius, and Tarquinius Superbus continued; and the consul Horatius Pulvellus, a few years after the expulsion of the kings, completed it, with a solidity and magnificence, says Tacitus, "which the riches of succeeding ages might adorn, but could not increase." It was burnt during the civil wars between Marius and Sylla, and rebuilt shortly after; but again destroyed by fire in the dreadful contest that took place in the very forum itself, and on the sides of the capitoline mount, between the partisans of Vitellius and Vespasian. However, the capitol rose once more from its ashes, with redoubled splendour, and received from the magnificence of Vespasian, and his son Domitian, its last and most glorious embellishments. The edifices in site and destination were probably nearly the same as before the conflagration; but more attention was paid to symmetry, to costliness, and, above all, to grandeur and magnificence. The northern entrance led under a triumphal arch to the centre of the hill, and to the sacred grove, the asylum opened by Romulus, and almost the cradle of Roman power. To the right, on the eastern summit of the hill, stood the temple of Jupiter Feretrius; to the left, on the western summit, was that of Jupiter Custos: near each of these temples were the fanes of inferior divinities, that of Fortune, and that of Fides, alluded to by Cicero.

In the midst, to crown the pyramid formed by such an assemblage of majestic edifices, and at the same time to afford a becoming residence for the guardian of the empire, the father of gods and of men, rose the temple of Jupiter Capitolinus, on a hundred steps, supported by a thousand pillars, adorned with all the refinements of art, and blazing with the plunder of the universe. In the centre of the temple, with Juno on his left, and Minerva on his right, the Thunderer sat on a throne of gold, grasping the lightning in one hand, and in the other wielding the sceptre of the universe.

In the midst of these magnificent structures, of this wonderful display of art and opulence, stood for ages the humble straw-roofed palace of Romulus, a monument of primitive simplicity, dear and venerable in the eyes of the Romans. The cottage vanished in the first conflagration: but not the cottage only, the temples, the towers, the palaces, that once surrounded it, have disappeared; and of all the ancient glory of the capitol nothing now remains but the solid foundation, and vast substructions raised on the rock; and even its very name is almost lost in the semi-barbarous appellation of *Campidaglio*.

At present the capitoline mount is covered with buildings, far inferior, without doubt, to the imperial edifices above described, but yet of grand proportions, and vast magnitude. The northern, still the principal entrance, is an easy ascent, adorned with a marble balustrade commencing below, with two immense lionesses of Egyptian porphyry, pouring a torrent of water into spacious basins of marble, and terminated above by statues of Castor and Pollux, each holding his horse. At this place is the entrance into the square, in the centre of which stands the well-known equestrian statue of Marcus Aurelius; and in front, and on each side, are three extensive buildings, erected by Michael Angelo. The Museum Capitolinum contains, in several large rooms, a most splendid collection of busts, statues, sarcophagi, &c. bestowed by different popes and illustrious personages on this magnificent cabinet, devoted to the use of the Roman people, or rather of the literary and curious of all nations.

Anciently there were two ways from the capitol to the forum; both parted from the neighbourhood of the Tabularium, and, diverging as they descended, terminated each in a triumphal arch, that of Tiberius to the west, and of Severus to the east: of these arches the latter only remains. The descent at present is a steep and irregular path, winding down the declivity from the senators' stables, without any regular termination. The traveller, as he descends, stops to contemplate the three corinthian pillars, with their frieze and cornice, that rise above the ruins, and preserve the memory, of the temple of Jupiter Tonans, erected by Augustus as a monument of his preservation from a thunderbolt that fell near him. A little lower down, on the right, stands the portico of the temple of Concord, built by Camillus, consisting of eight porphyry pillars, with capitals and entablature of irregular ionic. To account for this irregularity, it is to be remembered, that the edifices on the sides of the hill shared the fate of the capitol, in the contest which took place between the parties of Vespasian and Vitellius, and were rebuilt shortly after by Titus and Domitian, and afterwards by Constantine. Hence the word "restitutum" in the inscription, and hence the want of regularity in some parts of the buildings, which being monuments of republican Rome, did not perhaps enjoy the favour of the emperors. The triumphal arch of Septimus Severus is nearly half buried in the ground. *Eustace's Tour through Italy*, 1813.

Capreoli. The struts or braces of a trussed roof, in ancient carpentry.

Caracol. Is sometimes used to denote a staircase in the form of a helix or spiral.

Caravansera. A large public building, or inn, in the east, destined for the reception of travellers, and the lodging of caravans. The caravanserai are huge square buildings, with a spacious court in the middle of them. They are encompassed with galleries and arches, under which runs a kind of banquette, or elevation, some feet high, where travellers rest themselves, and make their lodgings as well as they can; their baggage and the beasts that carry them being fastened to the foot of the banquette. Over the gate there is frequently little chambers, which the caravanseraskier, or keeper, lets out at a very dear rate to such as wish to be retired.

Though the caravanserai serve in lieu of inns, yet there is this essential difference between them and our inns, that the traveller finds nothing at all in the caravanserai either for himself or his cattle, but must carry all his provisions and necessaries with him. They are chiefly built in dry, barren, desert places, and are generally furnished with water from a great distance, and at a vast expense; there being no caravansera without its well of water. There are several of them in cities; where they serve not only as inns, but as shops, warehouses, and even exchanges.

Carcass. The shell or ribs of a house before it is lathed and plastered, or the boards are laid.

Carcass flooring. See *Naked Flooring*.

Carcass roofing. See *Roofing*, *Carpentry*, &c.

Cardinal scapi. *In Roman Joinery.* The stiles of doors.

Cariates, or cariatides. See *Caryatides*.

Carina. A term in ancient Roman architecture, for buildings in the form of a ship.

Carneddе. *In British Antiquity.* Denote heaps of stone, supposed to be druidical remains, and thrown together on occasion of confirming or commemorating a covenant.

Carolitic column. See *Column*.

Carpenter. An artificer, whose business is to cut, fashion, and join timber and other wood for the purposes of building. The word is formed from the French *charpentier*, which is derived from *charpente*, which signifies timber.

Carpenter's rule. See *Rule*.

Carpenter's square. See *Square*.

Carpenter's work. See *Mensuration*.

Carpentry. The art of employing timber in the construction of edifices.

Though carpentry is unquestionably of very high antiquity, our information with respect to its history is short and scanty, and Pliny and Vitruvius are the only ancient writers upon this subject, whose works have reached modern times. The observations of these authors, being chiefly confined to the choice and selling of timber, are of no use as to the constructive part, and merely demonstrate that such an art then existed.

The remains of Egyptian architecture present, perhaps, the only example of a complete system of building without the use of timber, while, at the same time, arches and vaults were unknown; for many Roman edifices, as the pantheon, temple of peace, &c. might be quoted, which, by means of vaults, are independent of carpentry. In the Egyptian construction, however, flat roofs of massy stone were used, which it was necessary to support by thick set avenues of columns, arranged at small equal distances over the whole area. This form, though sufficiently striking and picturesque, was of course incommodious, and only adapted to a dry climate. A pediment roof, therefore, was the first effort of constructive carpentry: this answered the purpose of an effectual shelter by throwing off the humidity of the skies; at the same time that the rafters, in connection with the transverse beams of the ceiling, formed a truss which would be gradually improved, and thus give the means of covering a wide space, without any other support than the external walls.

The invention of pediment roofs leads us naturally to Greece, where this member was an essential part of architecture. Besides forming roofs, the Greeks appear to have used carpentry in the framing of floors, and for rustic buildings and other purposes. But in a warm climate, abounding with stone and marble, it is not probable that wood was much used in the internal finishing of any edifices, except for those objects wherein lightness and tenacity are essential qualities, as doors: though there are some remains of marble doors.

Among the Romans, the use of wood was much more common; and they appear to have applied the art of carpentry to nearly the whole of the purposes common to the moderns.

In more modern times, the art of carpentry has been much cultivated; and the works of Palladio, Serlio, De l'Orme, Moulineau, Perronet, and Sir Christopher Wren, exhibit many admirable specimens. At the present time it has begun to assume a scientific form; and, in England, the accuracy and celerity of execution of the workman are unequalled.

The art of employing timber in building is divided into two grand branches: carpentry and joinery. The first includes the larger and rougher kinds of work, and that part which is material to the construction and stability of an edifice; and, generally, all the work wherein the timber is valued by the cubical foot. The second includes all the interior finishing and ornamental wood-work, and is valued by the superficial foot.

Carpentry, or that branch which is now to claim our attention, is divided into three principal heads, viz. *constructive*, *descriptive*, and *mechanical*.

Of these, descriptive carpentry shows the lines or methods for forming every species of work in plano, by the rules of geometry: constructive carpentry, the practice of reducing the wood into particular forms, and joining the forms so produced, so as to make a complete whole, according to the intention or design: and mechanical carpentry displays the relative strength of the timbers, and the strains to which they are subjected by their disposition.

These three branches will be particularly developed under their respective heads. It being our intention, in the present article, to trace carpentry through the several stages of its improvement in England; and by that means make the reader acquainted with whatever is valuable and worthy of transcription in the works of such authors as have preceded those of the present day.

The first English writer, in point of time, that we have met with on this subject, is Godfrey Richards; who, at the end of his "*Translation* of the First Book of Andrew Palladio," published in 1676, writes thus:—

"*Of roofs.*—Rules and instructions for framing all manner of roofs, whether square or bevel, either above pitch or under pitch, according to the best manner practised in England.

"Also to find the length of the hips and sleepers, with the back or hip mould, never yet published ed by any architect, modern or antique; a curiosity worthy the regard even of the most curious workmen, exactly demonstrated in the following rules and designs, by that ingenious architect Mr. William Pope, of London.

"Having raised the walls to their assigned height, and made the vaults, laid the joists, brought up the stairs, and performed all those things spoken of before, we are now to raise the roof, which embracing every part of the building, and with its weight equally pressing the walls, is as a band to all the work; and besides, defends the inhabitants from rain, from snow, from the burning sun, and from the moisture of the night; adds no small help to the building, easting off from the walls the rain water, which although for a while seems to do but little hurt, yet in process of time is cause of much damage. The first men (as saith Vitruvius) built their houses with flat roofs, but finding that thereby they were not defended from the weather, they (constrained by necessity) began to make them ridged, that is to say, raised in the middle; these roofs are to be raised to a higher or lower pitch, according to the country in which they are: wherefore, in Germany, by reason of the great quantity of snow that falls there, they raise their roofs to a very great pitch, and cover them with shingles, which are small pieces of wood, or of thin slate or tiles; for if they would raise them otherwise, they would be ruined by reason of the weight of the snow. But we who dwell in a more temperate country ought to choose such a pitch which may secure the building and be of a handsome form; therefore, we divide the breadth of the roof into four equal parts, and take three, which makes the most agreeable pitch for our country, and is the foundation for raising any manner of roof, whether square or bevel, as appears in the following designs and descriptions.

"*Plate* 13. *Carpentry. The manner of framing a floor, with the names of each member.*

"1. The thickness of the wall and lintel, or wall plate; and if it be in timber-work, then a bressummer.

"2. The summer.

"3. Girders framed into the summer.

"4. Spaces between the joists.

"5. Joists.

"6. Trimmers for the chimney way.

Trimmers for the staircase, or well-hole, for the stairs.

"*Of the design. Plate* 14. *Carpentry.*—A A, the breadth of the house, cantilivers, cornices, and eaves.

"A B, the length of the raftings and furrings, which ought to be one-quarter of the breadth of the house A A.

"The principal rafters to be cut with a knee, (as in the design,) that they may the better support themselves and the burthen over them, upon the upright wall, and also secure that part from the dripping in of the rain; which otherwise would happen if the rafters were made straight and furred.

"The beam to the roof, or girder to the garret floor, ought to project without the work as far as the furring or shredding, which is the projecture of the cornice.

"This manner of framing the roof will be useful from 20 to 30 feet or thereabouts.

"1. Ground plate.

"2. Girder or binding interduce, or bressummer.

"3. Beam to the roof, or girder to the garret floor.

"4. Principal post and upright brick wall.

"5. Braces.

"6. Quarters.

"7. Interduces.

"8. Prick post or window post.

"9. Jambs or door posts.

"10. King piece or joggle piece.

"11. Struts.

"12. Collar beam, strut beam, wind beam, or top beam.

"13. Door head.

"14. Principal rafters.

"15. Furrings or shreddings.

"16. Ends of the lintels and pieces.

"17. Bedding moulding of the cornice over the windows, and space between.

"18. Knees of the principal rafters, which are to be of one piece.

"19. Purlin mortises.

"*Design of the gabel end or roof. Plate* 15. *fig.* 1.—Let the whole breadth of the gable end roof be 20 feet, divide the same into 4 equal parts, take thereof 3 for the principal rafter, and placing that perpendicular from the point C to the point D begets the length of the sleeper A D, which will be 18 feet; and the length of the dormer's principal rafter from A to E, when laid to its pitch upon the back of its principals, will reach to level line F B, or top of the principal rafter; and this is a general rule for all breadths.

"1. Summer or beam.

"2. King piece, crown post, or joggle post.

"3. Braces or struts.

"4. Principal rafters.

"5. The sleeper.

"6. Purlin of the dormer.

"7. Principal rafter of the dormer.

"8. Single rafter of the dormer standing on the sleeper and purlin.

"9. Point of the sleeper.

"10, 11. Thickness of the wall and lintel, or wall plates.

"*Of the Italian or hip roof. Plate* 15. *fig.* 2.—A A, the breadth of the roof, being 20 feet.

"A B, the length of the sleepers or hips, being 18 feet, which is proportionable to the breadth of the house.

"E D, the height of the roof perpendicular.

"C D, the length of the hip, and the angle which it maketh upon the diagonal line, which is showed by the prick line G, from F to C.

"1, 2. The wall and lintels.

"3. Dragon beam for the hip to stand on.

"4. Beam or summer, wherein the dragon beams are framed.

"5. King piece or crown post.

"6. Struts or braces, from the crown post to the hip rafter.

"7. Hips as they make the angle equal to the breadth of the house.

"8. Hips as they make the angle in the diagonal line from corner to corner.

"9. The additional length which the hips make upon the diagonal line more than the breadth of the house.

"*Of flat roofs. Plate* 16. *fig.* 1.—Within a camber beam and rafters joggled in, whose weight lyeth not chiefly in the middle, and may be so made, that, without hanging up the beam, the principals may discharge the weight; and how drips may be made to walk on.

"1. Camber beam.

"2. Principals joggled into the camber beam.

"3. The place where the principals are joggled in.

"4. Puncheons or braces.

"5. Drips to walk on, and may be made with the less current, that the roof may be made the more pitch for strengthening thereof; and may be made higher or lower according to the building or discretion of the architect.

"6. Battlement.

"*Fig.* 2. A flat roof with a crown post or king piece.

"*Of the hip roof. Plate* 16. *fig.* 3. *Instructions to find the length and back of the hip, so as it may answer the side and the end of the perpendicular line of the gable end, the two skirts, the side of the roof in plano, or lying in ledgement with the hip and gable end, the diagonal and perpendicular lines being laid down proportionable to any breadth or length, by which the most ingenious may serve himself, and an ordinary capacity (already acquainted with the use of the ruler and compass) may plainly demonstrate all the parts of a roof, whether bevel or square, above pitch or under pitch, by lines of proportion, as may appear in the design following.*

"Suppose the roof 20 feet broad, and in length 30, 40, or 50 feet, more or less. Let A B C D be the sides and ends of the said roof, one end to be hipt, the other a gable end. Draw the lines A B C D the breadth and length of the roof; then draw the gable end A B C, whose sides or principal rafters being three-quarters of the breadth of the house; then draw the perpendicular line E F, the height of the gable end, which line is of general use to level the ridge of all roofs; and if the other end be kept as in the design D C G, then it serves to find the length of the hip, and the back of the hip, so that it may answer both sides and ends of the roof, always observing that the middle of the breadth of the house is as I H; then draw the line K L N through the centre I, which will make right angles to the line E F H G, both in bevel and square houses; then extend the line A B on both sides to O, being the length of A E or E B, the length of the principal rafters, or three-quarters of the house; so will O N and O K make the length of the ridge I F, and K D and C N the two skirts.

"*To find the length of the hip.*—Draw the diagonal line D I and I C, over which the hip is to hang when in its due place, then take the perpendicular line E F and place it from the point I to P P, perpendicular to the diagonal or base lines D I and I C, at I. So is I P and J P the pitch of the hip equal to the gable end E F, and, when erected, will hang perpendicular to the point I.

Then take P D, the hypotenuse of the triangle D I P, and C P, the hypotenuse of the triangle C I P, placing them from D to G, and C to G gives the length of the hip D G C, and when laid to their pitch, will all meet perpendicular to their point I.

"*To find the back of the hip, so that it may answer both sides and ends of the roof, whether square or bevel.*

"Lay the ruler from the point L to the point H, and from the point H to M, and mark where it cuts the diagonal lines D I and I C at Q Q, then set one foot of the compasses on the point Q, and extend the other foot to the hip lines D P and C P, at the nearest distance, with that mark the point R, upon the same diagonal lines, then draw the pricked lines L R H and H R M, which makes the back of the hip for the two corners of the roof.

"This rule serves for all roofs, whether over or under pitch.

"*Of roof, bevel at one end and square at the other, the gable end square, and the bevel end hipped. Plate* 17. *fig.* 1.—Suppose the breadth of the roof 20 feet, the length more on one side than the other, as in the design A B C D, then draw the gable end A E B, whose side, from A to E and from E to B, is one-quarter the breadth of the house, or is the length of the principal rafters; then draw the perpendicular E F, the height of the roof from the floor; and if kneed, then from the top of the knee, as in the design of a kneed rafter beforegoing.

"The sides of the roof, which makes the ridge G H I K, to be drawn as is described in the foregoing design.

"Divide the breadth of the roof in two equal parts, as F L Q, then take the distance L N, which is the half breadth of the house, and make it parallel to C Q D, as M L M and L will be the point whose perpendicular, O T, will meet the principal rafters and hips.

"*To find the length of each hip distinct from each other. Of the longest hips.*—Draw the diagonal line L C, and take the height of the gable end E F, and place it perpendicular to L C at O: so you have the height of the roof perpendicular from O L equal to E F, the gable end; and line O C will be the length of the hip rafter, which will be equal to C H, the skirt for that side of the hip, and C P the side of that hip end.

"*To find the back of the longest hip* C O.—Lay the ruler from the point M to Q, and mark where it cuts the diagonal line at R, then set one foot of the compasses at the point R, and extend the other foot till it touch the line C O at the nearest distance, then make it touch the diagonal line at S, then draw the lines M S Q, which is the back of the hip for that corner of the roof.

"*To find the shortest hip.*—Draw the diagonal line of L D and take E F, the perpendicular of the gable end as before, and place it from L to T perpendicular to L D, then draw the line J D, which is the length of the hip for that corner, and is equal to the skirt D I, and the side of that hip D P, which, when erected, will meet with the other principals perpendicular to the point L.

"*To find the back of this hip.*—Lay the ruler from the point Q to the point M, and mark where it cuts the diagonal line L D at V. Extend the compasses from the point V, to touch the line T D at the nearest distance, and carry that distance on the diagonal line to the point W; then draw the pricked lines M W Q, which will make the back of that hip fit for that bevel corner. And this rule serves for all bevel roofs, whether over or under pitch.

"*Of a roof bevel at both ends, and broader at one end than the other. Plate* 17. *fig*. 2.—A B C D, the length and breadth of the house.

"E F G, the length of the rafters or pitch between the widest and narrowest end about the middle of the house, to stand over the pricked line T T, as the foot F to stand on the one T foot G to stand on the other T.

"H H, the point of the two hip ends, when brought to their due place, will be perpendicular to P P, and will meet the sides I K L M over the points P P.

"O O O O, the points of the perpendiculars and length of the hips from A B C D.

"Q Q Q Q, the backs of the hip or hip mould to each corner.

"R R R R, the points to find out Q, the point for each back.

"S S S S, the lines representing half the breadth of the house, parallel to each end.

"T T, representing the middle of the house.

"Notwithstanding the bevel ends you may place your beams for your principal rafters to stand on, square, or so near a square as may be, or between both, as from the ends of the pricked lines I K L M, bringing the outside of them straight under P, which will be more handsome for the house in the inside, although it bevels outward."

The preceding comprises the whole of the information contained in Godfrey Richards's work relative to carpentry. In the explanation to *plate* 13, we are made acquainted with the names of the several timbers which constitute a floor, and the manner in which they are disposed: in the explanations to *plates* 14, 15, and 16, the manner of framing a roof and in *plates* 16 and 17, is shown the manner of finding the lengths and backs of the hips, as at present, which discovery he generously ascribes to Mr. Pope.

In modern buildings, wherever the same things are used, the same names are, with but few exceptions, retained. Of these exceptions, however, we shall briefly take notice. The *interduces* are now called *interties*; the word *prick-post* has been superseded by the terms *jamb-posts*, *window*, or *door posts*; the names *king-piece*, *crown-post*, or *joggle-post*, are now lost, and *king-post* substituted; the term *sleepers* is changed into *valley-pieces*, or *valley-rafters*; and of the words *collar-beam*, *strut-beam*, *wind-beam*, or *top-beam*, the term *collar-beam* only is retained.

In modern houses also there is some difference in the mode of construction: the *summer* not being used in the flooring; nor the kneed-rafters, and, consequently, neither the *shreddings* nor *furrings*, in the roofing.

The author who appears to have been the next to advance a step further in this department of the art of construction, is Mr. Halfpenny; who, in "*The Art of sound Building*," published in 1725, has the following observations:—

"*To find the angle or mitre bracket of a cove. Plate* 18. *fig*. 1. —First draw the base A B of the regular bracket, and from A draw A D, perpendicular and equal to it, and draw the line D B, and continue the line D A to C, so that A C be also equal to A B; then extending your compasses from A to B, and setting one foot in A, with the other describe the arch or quarter of a circle C B.

and from the point D draw D F, perpendicular to D B, and equal to D A or A C, and another as B E from B, likewise equal to D A, and draw the line F E, which will be parallel to D B. This being done, divide A B into a number of equal parts, not exceeding two inches and a half, and through the divisions of them draw lines parallel to A C, to touch the arch C B, which continue out to the line D B, and this line will be likewise divided into the same number of equal parts as A B is. Lastly, from the divisions of the line D B draw lines parallel to D F, and, in each of them, from D B, lay off its respective parallel (from A B to the arch C B) and at the points whereat they end, stick small nails or pins, and take a thin lath, and bend it round the nails or pins, observing that it touches them all, and with a pencil or any thing else proper to make a mark describe the arch F B, round the edges of the lath; and this is the arch for the angle or mitre bracket.

" *Plate* 18. *fig*. 2.—*If the lesser arch of an irregular groin be a given semicircle, it is required to form a larger one (not a semicircle) so that the intersection of these two arches shall beget, or make the arch-line of the angle to hang perpendicular over its base; as also to draw that arch-line of the angle.*

" First draw the lines A B and C D, to represent the walls from whence the arches spring, and draw the line C B, and on the line A C describe the semicircle A E C and divide A C into any number of equal parts, from whence draw parallel lines to C D, to touch, or come to the arch A E C, and if those parallels are continued out to the line C B, they will divide it into the same number of equal parts as A C is; and if from each of the divisions of this last line parallels to A C are drawn, they will divide the line A B into the same number of equal parts as A C or C B is divided into. This being done, continue A C to I, so that A I be equal to E *f*, and continue D B to K, so that K B be likewise equal to E *f*, or A I, and draw the line I K. Moreover, at the points C and B raise the perpendiculars C N and B O to C B, each of the same length as E *f*, or A I, or B K, and draw the line N O. Lastly, from the divisions of A B, draw parallels to A I, (that is, continue the parallels drawn from the divisions of the line C B, to the line I K,) and from the divisions of C B parallels to C N. Then set off the heights or lengths of each of the parallels in the semicircle of A E C, upon the correspondent parallels to A I and C N, and stick in nails whereat they terminate; and if a lath be bent round them, so as to touch them all, and a pencil be moved round the edge of it, the arches A H B and B M I will be found, which was required to be done.

" *Note*.—The pricked lines in this and all other examples of this kind, show that one parallel line has a relation with the other. For example; the lines *f* E, *g h*, and *l* M, are all equal to one another; so that if the three arches A H B, A E C, and C M B, were raised perpendicularly upon the lines A B, A C, and C B, and a line drawn from H to M and another from M to E; then would the line H M be parallel to and directly over the pricked line *b g*. In like manner, the line E M would be parallel to and directly over the pricked line *f b*. Understand the same of the other parallels and pricked lines in this figure and any others of the like nature.

"*Plate* 18. *fig.* 3.—*Having one centre given for an unequal-sided groin, to form the other, so that the intersection thereof shall produce the angle, or mitre arch, to hang perpendicularly over its base: and moreover to draw the curve thereof.*

"Draw the lines A B and B D, and D C and C A, each equal to one another, to represent the walls from whence the arches spring, and on the line A B describe the given arch A F B. This being done, divide the line A B into any number of equal parts, from whence raise perpendiculars to A B, to touch the arch A F B, and draw the diagonal lines A D, and C B. Then take the line E F, and set it perpendicular to the lines A C, A D, C D, C B, B D, from A to O, from A to I, from C to P, from C to S, from C to L, from D to K, from D to T, from D to V, and from B to M, and from B to Z, and draw the straight lines O P, I K, S T, L M, and Z V. Now divide the base lines D B, D C, C A, A D, and B C, each into the same number of equal parts as A B is divided into; and from the points of division draw parallel lines to touch the lines O P, S T, V Z, C M, and I K. Then take the lengths of the perpendiculars to A B, drawn to touch the given arch A F B, and set them off in the correspondent parallels, drawn from the points of division, of the several bases upwards, and the arches B y D, D v C, C q A, A h D, and C n B, will be described as in the foregoing example, (*plate* 18, *fig.* 2,) whose heights $x\ y$, $w\ v$, $r\ g$, $g\ h$, and $g\ n$, are each equal to E F, as likewise all the other correspondent heights from the bases to the curves that are formed.

"*Plate* 18. *fig.* 4.—"*The arch-line of a large ceiling or vault supposed to semicircular being given how to form the curve of a lesser arch, that shall intersect the side thereof, to give way for doors or windows, so that their insersection shall produce the groin to hang perpendicularly over its base; as also to form the curve line thereof.*

"First draw the lines A B, B D, D C, and C A, to represent the walls from whence the arches spring, and describe the two given semicircular arches O A B, C L D, and in the line D B set off the span of the intersecting arch from v to t. This being done, set off the height you design to raise the lesser arch $v\ z\ u$, from g in the line A O B, perpendicularly to touch the arch in h, and from v to R, and t to u, and draw the line R u, which halve in the point z, and draw the line $z\ y$ parallel to v R or $t\ v$. Then strain a line or lay a straight rule from h through g towards x; as also from z through y, towards x, and these two lines will cut one another at x, from whence to the points v and t draw the lines $x\ t$ and $x\ v$. Now set off $g\ h$ perpendicular to $x\ t$ from x to w, and from t to s, and draw the line $s\ w$, and divide g B into any number of equal parts at pleasure, from the divisions of which, draw perpendiculars to g B, to touch the arch B O A. between the points B and h, and divide $v\ y$ and $y\ t$, the halves of the base $v\ t$, each into the same number of equal parts as g B is divided into; as likewise the base $x\ t$, and from the points of division draw parallel lines to touch the lines u R and $s\ w$. This being done, take the length of the lines that were drawn from the points of division of B g, perpendicularly to touch the part B h, of the arch B O A, and set them off in the correspondent parallels from g to v R, and from $y\ t$ to $z\ u$; as likewise from *x t* to *w s*. Then if at the extent of each line, as you set it off in the parallels, you stick in nails, as in the foregoing examples, and bend a thin ruler about them, you will describe the sought arches *v z t*, and *w t*, whereof *v z t* is the true intersecting arch, and *w t* the curve line of the groin that is correspondent thereto.

"After the very same manner the arches *k m z* and *k p* are drawn.

"*Plate* 18. *fig*. 5.—*How to form a semicircular niche with ribs, as is usual when it is to be plastered.*

"First, describe the semicircular plate, A C B, as also the semicircular front rib, A D B, equal to it, and fix the plate, A C B, level in the place where it is to continue, and upon it set the front rib, A D B, perpendicular on A B. This being done, describe the quadrantal ribs D C, D E, D G, and D H, each equal to A D or B D, and place them about eight inches and a half from one another on the plate A C B, as at C, E, F, G, and H, so as to meet in one point, at D, on the crown of the front rib, A D B; and thus is one half of the work finished. And after the same manner may the other be done.

"*How to form an elliptical niche, with ribs for plastering. Plate* 18. *figs*. 6, 7, 8.

"First describe the two figures 7 and 8, *k n m* being a semi-ellipsis, representing the plate whereon the ribs stand, and being equal to A D B or A *e* B. The pricked lines, *l n*, *l o*, *l p*, *l* R, and *l m*, represent the base lines of the ribs *e* D, *f* D, *g* D, *h* D, *i* D, and B D; so likewise do the lines *s t*, *s u*, *s w*, *s x*, and *s y*, and the perpendiculars *a t*, *b u*, *c v*, *d w*, *e x*, and *f y*, do represent the rising of the ribs *e* D, *f* D, *g* D, *h* D, *i* D, and B D, which is equal in length to C D; observing that within those lines the different arch of each rib is to be descrided, viz. the arch *s a* is a quadrant of a circle, having *t* for its centre, and is equal to the arch of the rib *e* D. The lines *u s*, *s z*, equal to *z b*, *b u*, are the semi-transverse and conjugate axes of a semi-ellipsis, whose arch, *s b* is equal to the arch of the rib *f* D, which may be struck either with a trammel, or by the intersection of lines. Moreover, the lines *s z*, *s v*, equal to *v c*, *c z*, are the semi-transverse and conjugate axes of a semi-ellipsis, whose arch is equal to the arch of the rib *g* D, and so of the rest. Now having the ribs all ready, set the front rib, A D B, perpendicular on the plate A *e* B, as at A B, and fix the feet of the short ribs on the plate A *e* B, as at *e f g h i*, which correspond with the points *n o p q r* and their points *a b c d e*, to the crown of the front rib at D; and thus may you finish your work."

The work that next comes under our consideration, is Smith's "*Carpenter's Companion*," published in 1733; and, though he presents us with nothing new, his observations are, in general, very judicious, and worthy of being transcribed.

His introduction commences thus:—

"The usefulness of carpenter's work in building, and the little notice taken of it by authors who have treated of architecture, and the few there be that rightly understand it, prompts me to write the following treatise.

"Carpenter's work is one of the most valuable branches of architecture; it was contemporary with the first ages of this world; with the knowledge of this art Noah closely and firmly connected those timbers together in the ark, which were so nicely wrought, that they not only kept the waters from penetrating into it, but was proof against the tempest and the rolling billows, when in its womb it carried all the tenants of the earth and air.

"Those naval preparations through all ages of the world, as well as those stupendous temples and edifices erected in [illegible] countries, demonstrate the perfection of this art. The innumerable floating buildings, which roll from one country to another, through tempestuous storms, tost from the mountain's height to the depths of the ocean, without injuring the vessel, evidently show the vast use and judgment of carpenter's work.

"But as that branch of it, as relates to templar or domal uses, is the subject of this work, I shall only treat of its usefulness in them; and I may venture to affirm, that carpenter's work is the chief tie and connection of a building, it is the ligaments which bind the whole together.

"The bond-timbers which strengthen and tie the angles of a building, and prevent its separating, is the work of the carpenter; lintelling over doors and windows, with other dischargements of weight, is his care to perform.

"Bond-timber in cross-walls, when settlements happen, if they are well applied, prevent the cracking of the walls, for that keeps the whole together, and every part settleth alike, which would fill the buildings with gaps and chasms if neglected.

"Next for floors; the rightly framing them by trussing the girders by placing them on joists, so that they come near no funnels of chimneys; the manner of tenanting, tusking, framing of trimmers, stairs, &c. I say, all these is the business of the carpenter to see carefully performed.

"Partitions of timber, their manner of trussing to prevent racking, settlements, &c. and the discharge of weight of girders, beams, or cross-walls, is carpenter's work, as is, likewise, the framing of timber bridges.

"Roofs of various sorts for common houses, large edifices, or churches, their manner of framing, the height of their pitch, their strength, usefulness, &c. with the various manner of performing all these works, is the subject of this treatise, which I have rendered intelligible to every capacity, by designs of every sort, and have described them in such a manner that will render the work useful to carpenters, in particular such who are unacquainted with the manner of performing these operations of framing.

"If it should be objected, that there are few things here treated of, but what every carpenter knows, I could wish such objectors had been at the pains I have taken to inform the world, since I reap no advantage from it, but the satisfaction of communicating any thing which may prove serviceable to my countrymen. I therefore conclude, *facile est inventes addere.*"

And am,
yours, &c.
JAMES SMITH.

"The first thing which a carpenter must consider, for the carrying on a building, is the plan in which you are to prepare your timber, in having it cut into proper scantlings, which shall be hereafter noted.

"You are to prepare for lintelling and bond-timbers; for lintels over doors or windows, stuff of 5 inches thick, and 7 broad, and it is a slight way of building to put in any of a less scantling; as for door cases, their manner of making, and scantlings of stuff, it is needless to speak of; it is the best way to have them put in when the foundations are brought up high enough for them. Bond timber should be dovetailed in the angles of the building and cross-walls, as represented in *plate* 19, *figs.* 1, 2, and 3; and here note that it is a durable but expensive way, to have all fir timber which is laid in the walls of a building to be pitched, with pitch and grease mixed together; the quantity of grease one pound, to four of pitch; all these things are the care of the carpenter.

" Bond-timbers should be 4 or 5 inches thick for cross-walls, and in the angles of a building, 6 or 7 inches, and proportionably broad, 6 or 8 feet long, in each wall, and it would not be amiss to place them 6 or 8 feet distance all the height of the building, in every angle and cross-wall; these, if a building be on an unfirm foundation, cause the whole to settle together, and prevent the cracks and fractures which happen if this be neglected.

" We come now to the floors, in which these things are to be observed: the magnitude of the room, the manner of framing, and the scantlings of the timber; for the first you are to observe to lay the girders always the shortest way, and not to have a joist, at any time, exceed 12 feet in length.

" The first and common method of framing floors is, as in *plate* 19, *fig.* 4, marked A, where the joists are framed flush with the top of the girder. The two cross joists, *a* and *b*, are called trimming joists; that marked *a* is supposed to be against a chimney; that marked *b* is the stairs; these joists are always thicker than common joists, being weakened by mortising. Scantling of joists, when a floor is framed in this manner, ought to be as followeth.

Common Joists.

Length in feet.		Scantling in inches.
5	....	7 × 2¼
6	....	7 × 2½
8	....	7 × 2¾
9	....	8 × 3
10	....	8 × 3¼
11	....	8 × 3½
12	....	9 × 4

Trimming Joists.

Length in feet.		Scantling in inches.
5	....	7 × 3
6	....	7 × 4
7	....	7 × 5
8	....	8 × 4
9	....	8 × 5
10	....	9 × 6

" These are such proportions as will render the work sufficiently capable of sustaining any common weight.

" The next manner of framing floors is that in *plate* 18, *fig.* 4, marked B, with binding joists; those six joists, marked *b*, are called binding joists, framed flush with the under side of the girder, and about 3 or 4 inches below the top of the girder to receive the bridgings; which are those marked *m* in the floor, and which lie across the binding joists, and are pinned down to them with pins of wood, or spikes of iron. These binding joists should be framed about 3 feet, or 3 feet 6 inches distance from one another, and their thickness 4 or 5 inches, or in proportion to the length of their bearing as trimming joists.

"These floors, if they settle out of a level with the building, are made level when after the bridgings are put on, which is generally after the building is covered in and near completed; they are generally double tenanted, as represented in *plate* 20, *figs*. 1, 2, 3, 4. The common tenanting is, as *figs*. 5, 6, 7, 8. That part of the floor marked D, *plate* 19, *fig*. 4, are the same joists, with ceiling joists tenanted into them, the binding joists are chased, and the ceiling joists, marked *n*, are tenanted into them, and put in generally after the building is up. These ceiling joists should be about 13 or 14 inches apart, and the scantling 2 and 3, or 3 inches square; and in large buildings 3 and 4. As for the bridgings which lie on the top of the binding joists, they may be placed 12 or 14 inches distance; the scantlings 3 and 4, or 3½ and 5, their bearing being only from binding joist to binding joist, which is 3 feet, or 3 feet 6 inches, and these are laid even with the top of the girder to receive the boarding.

"I come now to speak of girders; and first, for their scantlings, take these proportions.

Length in feet.	Scantling in inches.		
	Breadth.		Depth.
10	8	×	10
12	8½	×	10
14	9	×	10½
16	9½	×	10½
18	10	×	11
20	11	×	12
22	11½	×	13
24	12	×	14

"And here observe, that as every weight added to the weight of the timber in the floor itself occasions it to settle, the girder should be cut camber; if a 10 feet bearing, half an inch camber, if 20 feet an inch, &c. in proportion to the length of the bearing.

"And further to strengthen the girder, and prevent its sagging, as it is called among workmen, that is, its bending downward, I have, in *plates* 20 and 21, given several ways of trussing girders, which have been most of them practised. There are two sorts in *plate* 21, *figs*. 6 and 7, that I never saw any where performed.

"The manner of trussing these girders is, first, to saw the girder down the middle the deepest way; then take two pieces of dry oak, about 4½ or 5 inches wide, and 4 inches thick; let half the piece be let into one side the girder, and half into the other, as in *plate* 20, *fig*. 13, marked *a a*, which are the two trusses. *Fig*. 14 is another way, which is by cutting the girder through, and driving a wedge against the ends of the trusses, as wedge *d*. When these are thus prepared, bolt them together with iron bolts and keys, or much rather a screw at the end of the bolt: *figs*. 1 and 2, *plate* 21, are other ways of trussing.

"Some carpenters cut their girders down the middle and bolt them together without trussing, only changing the ends different from what they grew, whereby the grain of the wood is crossed, and it becomes much stronger than it would if it had continued without sawing down the middle, and thus putting it together.

"Some in trussing of girders make use of other trusses, as in *plate* 21, *figs*. 2 and 3, with butment, as *fig*. 5, marked B. In *plate* 21 you see those two trusses I spoke of, *figs.* 6 and 7, of my invention, with one inverted arch; I propose that to be of iron, marked A, which is let into the trusses; the upper arched one I take to be of great strength, though the trusses are inverted; for the pressure being upon an arch, whose butment is good, I think a great weight can no way occasion the bending the girder. *Fig.* 4 is a girder cut camber, but not trussed.

"The girder being thus trussed and put together, proceed in framing the joist, as in common floors; the strongest way being double tenanting and tusking, as is before shown in the bending joists, *plate* C 20. Before I leave this plate of floors, I shall observe to you, that the best and most workmanlike manner of framing floors, is to place all the upper edges of your joists straight, for the straighter and truer your joists lay the truer your boarding will lay, which is a great ornament to a magnificent room; but if you frame without binding joists, and lay on bridges, plane the bridgings and lay them very straight and level; this care taken will save a great deal of trouble in laying down the boarding, which you are often forced to chip and fur up to make them lay even, and those furrings are not only troublesome but are apt to give way, and occasion the creaking of the boards as you walk on them; it would be a good way to turn arches of brick over the ends of the girders of floors, because if any alteration happens they are easily taken out.

"I come now to partitions of timber, with their manner of framing. Timber partitions have these properties attending them; they take up less room and are cheaper than those of brick.

"As to roofs, there is a plate to go round the building, which may or may not be deemed a part of the roof; it may be deemed the foundation and tie of the roof and walls, or it may be taken as only that on which the roof lieth. These plates are to be dovetailed at the angles, and tenanted together at their lengths in several ways. The beams of the roof, which serve as girders to the ceiling floors, (and into which the principal rafters of the roof are tenanted,) are dovetailed, or what by workmen is termed, cogged down, to the plate, which prevents its flying out from the foot of the rafter, whose butment is against it; and in the angles of a building, pieces dovetailed across the angles of the plate, serve to keep it from spreading, and is the foot of the hip.

"The common pitch of roofs is to have the rafter's length, if it span the building at once, to be three-fourths of the breadth of the building. Some make them flatter, as a pediment pitch, and the old gothic way was to make them the whole breadth.

"The common pitch is not only unpleasing to the eye, but is attended with this inconvenience, if there is a gutter round the building, the steepness of the roof occasions the rain to come with so sudden a velocity into the pipes which are to convey the water from the gutters, that they fill the gutters, and sometimes so fast that the water runneth under the covering of the roof, and doth great injury to the timber, &c. of the building; and the steeper the roof is, the longer the rafters, and the greater quantity of timber must be used in the roof, as well as the more weight from the great quantity of timber, and the weakening the principal timbers, by adding more to its own weight.

"And the pediment pitch is inconvenient in lying too flat for these climates, so frequently subject to rain and heavy snows, which last would greatly press and incommode a building, and would lie much longer on the roof, its declivity being so small; besides, in keen winds, attended with rain, the rain would drive under the covering of slate or tiles, &c. and create much decay in the timbers.

"For the proportion of beams whose bearing varieth take the following rule:—

If the length of the beam in the clear be Feet.	The scantling must be in Inches.
12	6 × 8
16	6½ × 8½
20	6½ × 9
24	7 × 9½
28	7½ × 9½
32	8 × 10
36	8½ × 10½
40	8½ × 11
44	9 × 12

"Principal rafters should be nearly as thick at the bottom as the beam, and should diminish in its length one-fifth, or one-sixth, of its breadth; the king posts should be as thick as the top of the principal rafter, and the breadth according to the bigness of the struts you intend to let into them, the middle part being left something broader than the thickness.

"Struts may diminish as the rafters do, one-fifth or one-sixth of their length. In placing struts or collar beams, the dividing the rafter into as many equal parts as you prepare bearings, is the rule, because every part of the principal will have equal distant bearings.

"Purlins are the same thickness as the principal rafters, and the proportion of the breadth is 6 to 8, that is, if the rafter be 6 inches thick, let the purlins be 6 inches thick and 8 broad; if it be 9 inches thick, the breadth of the purlin is 12 inches.

"N.B. The purlins are those pieces into which the small rafters are tenanted, and they are tenanted into the principal rafters. Length of purlins are generally from 6 to 11 feet, not exceeding that length; small rafters, their scantlings 2½ inches and 4 inches, 3 inches, and 4½ inches, and 3½ inches, and 5 inches, according to the magnitude of the roof and the length of the rafters; small rafters should not exceed 7 feet in length in a purlined roof; if it happens that the length of the principal be above 15 feet, it is best to put in two tiers of purlins in the length of the rafters.

In respect to the construction of roofs for coves, he states, "that the use of coving a room of a considerable height is, first, the making it much lighter than it would otherwise be, if level in the ceiling; the rays of light in a cove are reflected back again into the room, which would otherwise be lost and confused in a room with a flat ceiling.

"Likewise, all rooms with circular roofs or ceilings are more commodious, and useful for entertainments of music; the angles of incident are always equal to those of reflection, so the undulation of sounds flying on any cove or spherical part of a building, reverberate on the audience; and if spherical no part of the sphere can receive the vibration, but it will return in the same angle from whence the undulation first began. The reflecting rays of light, and the reverberation of sounds, proceed from the same cause, and from incidents naturally affecting the eye and ear."

Having thus made the reader

acquainted with the information contained in Smith's "*Carpenter's Companion*," it is necessary for us to make a few observations on the same, that such as are inexperienced may not be induced to follow what is practically bad.

In *plate* C 19, *figs*. 1 and 2, he has given two very bad examples of dovetailing, which are very seldom if ever used. In *fig*. 3 he has shown the method of framing wall plates at the angles. This example, though tolerably good, is, nevertheless, much inferior to those used at the present day; and in *fig*. 4 he has represented four different, and very fair specimens of naked flooring.

Plate C 20, *figs*. 1, 2, 3, 4, 5, 6, 7, 8 show the manner of tenoning the binding-joists; *figs*. 9, 10, 11, 12, which he has altogether omitted to describe, are methods of lengthening beams; and *figs*. 13 and 14 are common trusses. Of the two former, *figs*. 3, 7, 9, 10 are the only fair examples; and even these might be considerably improved by the additions and alterations represented by the dotted lines. *Fig*. 3, by the addition of a step similar to that in *fig*. 7; *fig*. 9, by being altered to the shape represented, with the addition of a mortise; and *fig*. 10, by being cut bevel, and a mortise introduced in the centre. We have seen *fig*. 12 executed, but consider both that and *fig*. 11 of very little value. *Figs*. 13 and 14 are trusses in common use.

In *plate* C 21, he has shown various ways of trussing girders, but not one of them of sufficient practical utility to deserve our approbation.

The next work in priority of time is Price's "*British Carpenter*," which is, upon the whole, much more worthy of transcription. This author, after some useful observations in his introduction, treats of the scarfing of beams, the trussing of girders, and the various joints in roofing; he then proceeds to circular domes, and the method of covering polygonal buildings; and afterwards treats of the centrings of groins, the methods of covering the parts of coved ceilings, and the nature of oblique and rampant arches.

Mr. Price commences thus: "Nevertheless, it may not be improper in this place to mention some general observations. There is a moisture in all timber; therefore, all bearing timber ought to have a moderate camber or roundness, for, till that moisture is in some sort dried out, the said timber will sag with its own weight; and that chiefly is the reason that girders are trussed and used, as in its place will be shown. But here observe, that girders are best trussed when they are first sawn out, for by their drying and shrinking it tightens the trusses in them yet more.

"Observe also, that all beams or ties be cut, or forced in framing, to a camber or roundness, such as an inch in the length of 18 feet, and that principal rafters be also cut, or forced up to a camber or roundness as before. The reason of this is, that all trusses, though never so well framed, will sag, by the shrinkage of the timber and weight of the covering, and sometimes so much so as to offend the eye of the beholder; by this preparation, therefore, your truss will ever appear well.

"Also observe, that all case-bays, either in floors or roofs, do not exceed 12 feet, if possible; that is, do not let your joists in floors, your purlins in roofs, &c exceed 12 feet in their length or bearing, but rather let the bearing be 8, 9, or 10 feet, which should be observed in forming a plan.

"Also, in bridging floors, do not place your binding or strong joists above 3, 4, or 5 feet apart, and that your bridgings or common joists are not above 10 or 12 inches apart, that is, between one joist and the other.

"Here also observe, never to make double tenants, or tenons, for bearing uses. such as binding joists, common joists, or purlins; for, in the first place, it weakens very much whatever you frame it into; and in the second place, it is a rarity to have a draught in both tenons, that is, to draw your joint close by the pin; for the said pin, by passing through both tenons, (if there is a draught to each,) must bend so much, that without the pin be as tough as wire it must needs break in driving, and consequently do more hurt than good."

Plate C 22 represents Mr. Price's manner of scarfing, or pieceing of timber together.

"In *a* and *b* are shown joints for plates, lintels, or timber for ties; and if for beams, add the bolts as represented in the figures.

"Where more strength is required, *c, d, e, f* are applicable; which last may be done without wasting any of your timber. That of *d* is suited for an extraordinary use; for, by its being in two thicknesses, it may be made as strong in a manner as though in one piece. I do not propose to limit the length of these joints; but only to show their form of being framed or sabled together.

"In *g, h, i* is shown the manner of trussing girders that are to bear above 24 feet.

"First, cut out two pieces of timber, which together make the scantling proposed, with some good, dry, and straight grained English oak, of 4 inches by 3, or 6 inches by 4, as the nature of the thing shall require. Let half into one piece, as in *g*, at *l, m, n*, as tight endwise as it is possible to drive them in; then cut a vacancy in the other half, as *h*, which shall also drive on that of *h*, as tight endwise at *l* and *m*, as it is possible; lastly, bolt them together, as is shown above, and they are fit for use.

"In *i* is yet a stronger method, because it divides the bearing into three equal parts.

"As before, let in the pieces *o, p, q, r*; and at the foot of *o* and *e*, you may mortise through both flitches, by which you may, with a wedge, tighten the said girders, when the building is covered in; which conveniency is worthy of the strictest regard, and requires to be well performed.

"In K is the way proposed or taught by Leon Baptist Alberti. Take two pieces or flitches, being well dried, and turn the but-end of the one to the top end of the other without trussing at all, and bolt or screw them together; the short lines at the ends of the truss represent the walls to bear them when down."

Plate C 23 represents his method of framing timber together.

"At A is the joint of a principal rafter, as *d*, framed into the top of a king post, as *e*, and is generally framed, as F G.

"At B is the joint of a strut or brace, as *f*, framed into the bottom of a king post, as *e*, and may be framed, as F G: this is when timber is scanty; or else the best way is at C, because a square joint takes the full force of the weight; let *b* be the king post, and *a* the strut or brace, and framed, as F G.

"In D is shown a different

manner, for variety, and may be framed, as H I; because then the butment on the side of the tenon may be cut as the pricked line *h*; though the joint next the eye be as appears at *g*.

"Let K represent a beam, and I a principal rafter: it is to be framed, as H I, for then the butments give it a greater strength.

"In F G is shown the proportion a tenon or mortise ought to bear to the stuff to be made use of, for the aforesaid uses or partitions.

"In H and I is the proportion for the tenon or mortise for the use observed above.

"In K and L is shown the proportion the tenons and mortises of floors ought to bear to the depth of the stuff to be used; and here it may not be amiss to observe, that I do not insist it ought to be exactly so, but at the same time the nearer the better."

In *plate* C 24, Mr. Price has given the plan of a house, and the manner of arranging the principal timbers.

"Considering," says Mr. Price, "that difficulties often arise from placing timbers different ways, it is necessary to observe how they are to lie, and also how they shall be framed.

"Therefore, here is the plan of a house; in which is shown, by the pricked lines, the best way of placing your principal timbers, so as to lie firm; that is, not to lay them over doors or windows, nor too near chimneys, and at the same time, to have the boards lie all in one way, which is generally the way that you have the best vista; as M, N, O.

"Because I would not confuse the plan, by showing the manner in which the floors are to be framed, observe the floors of three rooms, as P, Q, R. That of Q is called bridging-floors, as being framed with a binding or strong joist in every 3 or 4 feet distance, and flush to the bottom of the girder; so that when the house is covered in, you pin down your bindings thereon, flush with the top of the girder: and this is the best way of carcass flooring. That of P and R may as well be framed flush to the top of the girders in each, and have every third or fourth joist the depth of the girder, and those between more shallow.

"In T is shown the manner of bridging floors: *a* and *b* represent the ends of two binding joists, on which is the bridging *d c*: into these binding joists are framed the ceiling joists *e f g*.

"In V is shown two deep joists of the other floors, or common way, as *l m*; and also three shallow ones, as *n, o, p*; and also the ceiling joist, *q*. And because these deep joists, as well as binding joists, are so prepared as to put in the ceiling joists, when the house is covered in, observe in S, the supposed side of either, with the mortises for the said ceiling joists, as *h*, a single mortise; and *i* and *k*, double or pulley mortises."

In *plate* C 25, Mr. Price has represented a floor, and roof, lying in ledgement; and in his description observes that,

"Every man who frames roofs, does first piece his plates, cock or dovetail down his beams on the said plates, and prepare pieces on which his hips are to stand, as appears in this plan Q, as at Y Z.

"Then he frames his principals, as R; and likewise his hip, as S, into the pieces prepared for them to stand on: and although all these respectively are framed, for the generality, on the floor, and which in practice is the best way, they are here placed by themselves to avoid confusion.

"I hope the pricked lines are enough to show that the skirts, T, V, W, X, are laid out agreeably to the plan Q; and in which are shown that one purlin lies above the strut, and the other below it; for if all were to lie in a right line, in the first place it cuts the stuff to pieces, so as to weaken it still more, and at the same time you lose your pinning.

"Here is shown a method to turn up your hip most exactly true without backing at all; and is thus: your hips being first framed into the piece they are to stand on, take a broad board, or small panel, lay it on the piece where your respective hip stands, and there mortise it as if it were your beam; cut off the corner of it, so as to make it more agreeable to your plan, whether square or bevel; lastly, when you come to turn up your hip in framing the skirts, slip this mould, as Y, upon the tenon at the foot of your hip, and there give it a tack with a nail; the angles of that board will turn up a hip, as desired, and is far preferable to any other method whatever."

Plate C 26.—"But because buildings must sometimes be bevel, and necessity requires the beams to be laid so, to miss some chimney or window; therefore let A represent a bevel plan, and whose beams also lie bevel: I doubt not but the pricked lines will show how much each principal rafter must lie bevel, at the time of framing; and that is, just as much as half the beam does, that the rafter stands on; the skirts B, C, D, E are the same way shown as before.

"The method described in *plate* C 25, with being separately applied, will turn up each hip, and also each principal rafter.

"I hope it will not be taken ill, my saying that a man must be deprived of sense, who would run into this almost endless torment, of cutting his timbers all bevel, unless some unavoidable necessity require it, such as above observed."

Mr. Price next proceeds to treat of roofing, and the mode of constructing timber bridges, after which he enters upon the construction of circular domes, and shows, for the first time, how their purlins are to be squared.

Plate C 27.—"Of what has hitherto been described, nothing appears so beautiful when done, as domes, or circular roofs; and, as far as I can perceive, nothing has appeared so difficult in doing. Therefore it will be proper to speak something of them.

"Let B represent a plan; in which let *b*, *b*, *b*, be the plate on the supposed wall; and let *c*, *c*, *c*, be the kirb, on which stands a lantern or cupola; also let *a*, *a*, *a*, represent the principal ribs.

"From the plan B make the section A; in which the kirb, or plate *b*, should be in two thicknesses; as also that of *c*, by which it is made stronger: and indeed, the principal ribs would be much better in two thicknesses. The best timber for this use is English oak, because abundance of that naturally grows crooked. As to the curve or sweep of this dome A, it is a semicircle; although in that point every one may use his pleasure. And in it are described the purlins *d e*, from which perpendiculars are dropped to the plan B; so that *f* is the mould the lower purlins are to be cut out by, before they are shaped or squared for use; and that of *g* is the mould for the upper purlins.

I rather show it with purlins, because under this head may be shown the manner of framing circular roofs in form of a cone.

"To shape or square these purlins, observe in A, as at *d* and *e*, they are so squared, that the joints of the supported small ribs are equal. Observe, as at *e*, the corners of the purlins, from which the perpendiculars are let fall to the plan B. So that your purlin being first cut out to the plan required, as appears in *e*, and also to the sweep *f*; so that *k* is the mould for the bottom, and *l* the mould for the top; by which, and the lines from the corners of the said purlin *e*, the same may be truly shaped or squared.

"N. B. This particular ought to be well digested, it being a principal observation in a circular roof.

"And from the purlin *a* in the section A, perpendiculars are dropped to the plan B, and in which it appears that *h* is the mould for the top, and *i* the mould for the bottom, so may this also be squared, which completes the performance. As to other particulars, due inspection will explain them. If any should say, a dome cannot be done so safe without a cavity as usual, let them view St. Stephen's Walbrook, Stocks Market, built by that great architect Sir Christopher Wren."

He then continues, with some particular observations on the manner of covering lanterns or cupolas.

Plate C 27. "Let C be the plan, the upper part of which is made half an octagon.

"It is observable, that a circular roof, as D, should extend no further than the upright of its support, and there made so as to carry off the water; whereas an ogee roof, as E, may extend to the extremity of the cornice, without injury to its strength, or offence to the eye of the most curious. Also a hollow roof, as F, may extend to the extremity of the cornice.

"It appears to me, that the many angles of a cupola give it beauty; therefore the sweep G is a regular curve, the base line, *l k*, being taken from the angle of the octagon in the plan C, as at *l k*. This curve G is divided into a number of equal parts. In order to trace the common rib H, from the said angular rib G, observe in C the base of the common rib *f l*, which is placed in H as from *l* to *f*; continue the perpendicular *l* at pleasure; take the base *l k* in G, on which are the perpendiculars dropped from the curve, and observe to place that distance *k l* in G, from *f* in H, to any part where it cuts the perpendicular *l* in H, as at *m*; from those divisions raise perpendiculars. So, by continuing base lines from the divisions in G to these perpendiculars in H, their intersection or meeting is a curve or sweep exactly agreeable; and which indeed may serve as a standard rule to trace any moulding whatever.

"To back the said angular bracket F, observe to describe the thickness of it on your plan, as in C at K; which shows how much your mould must be shifted, as may appear in F. This also may be observed to be a general rule for the backing of any bracket."

In *plate* 28, Mr. Price has shown the nature of centring of groins.

"Let A be a plan of a vault to be centred for groins. At *a b c d* are piers, generally prepared in and with the foundation, which near the weight of the brickwork. First, resolve on the curve you would have, as *a e c*, being a semicircle, which is shown by the section B. Begin in A, at *d e c*, centre it through as if it were a common vault, and board it; which being done, to make your groin, set centres, as from *a* to *c*, and from *b* to *d*; divide the curve *d e c* into four equal parts, as at *g* and *f*; so is *g e f* small centres you will want to nail on the centres first boarded, whose place or plan is at *h*; these small centres may be put in at pleasure, according to the bearing of your boards, that is, as to the distance between each centre. To make your groin straight on its base, at some little height over the centres strain a line from *b* to *c* or *d* to *a*; from which drop perpendiculars on your boarding, first fixed at as many places as you please, there drive in nails, and bend a straight rod till it touch them all; and then with a pencil or chalk, describe the curve so formed, to which bring the boards to be nailed on these little centres, and their joints will form a straight groin. If this should be disapproved of, in the next plate is a more accurate method.

"Let C be a plan of greater extent, and which suppose to be supported by two piers, as *f l*. The section D is composed of entire semicircles; then, consequently, your curves on the section E will be elliptical, as *b* in *d*, and may be described with a trammel, or traced (by proposition K) as in *f* may appear. What was said of A explains this at one view.

"If these pillars should be in the way, view the plan and sections again. First form some principal curve, as in D, at *a g h b*; being an ellipsis, so that the centres will be a gothic sweep, against the windows, as *e g a*, trace the curve *d h b*, in E, agreeable to *e g a*, in D, with which centre it as shown in A, and make good your groins to the sides. Lastly, make a flat centre, as at *g h i k*, which flatness is shown in either of the profiles or sections D or E, and fix it on your centres before completed, which, doubtless, due inspection will make plain; and hereby you avoid the pillars, and are equally as firm.

"N. B. The cause of those centres against the windows being a kind of gothic arch, proceeds from their making part of the whole sweep or arch, which, though it does not add to its beauty, it does to its strength in a particular manner.

"Regarding variety, I have given here another method for vaults, and which indeed may give more pleasure to the reader, as being a curiosity never before published, and may appear more intelligible than that in the foregoing plate.

"View the plan G, and its section H, which is composed of entire semicircles, as *b f e*. See also section I, which is an ellipsis traced from *b f e* in H: but for use, nothing is more true than the trammel, as shown in proportions L M. This I suppose is so plain as to need no explanation, otherwise than what was said in the foregoing plate as on figure A.

"See this plan again, and also its section I, from which is described the curvilineal face K, and also the face of the semicircular arches, as L, all being alike. And this is what I call a more accurate method of finding the groin, so as to be straight over its base, and at the same time gives a standard rule whereby to account for any curve or face of a ceiling whatever. The curve in I is divided regularly, though seemingly into unequal parts, which being drawn to the groin in the plan G, as appears by the figures 1, 2, 3, 4, 5, 6, 7, 8, 9, and which are transferred into L at 1, 2, 3, &c. Also the circle *b f e* in H, is divided into eighteen equal parts; the half consequently into nine; which appears from *b* to *e* in L. This method doubtless will be plain, and therefore needs no further explanation.

"That of K belongs to the section I, extended as it were; and that of L belongs to one of the small arches of H, also stretched out, they being all alike.

"N. B. To find the groin by a more common method, do thus: erect a straight piece of board, or the like, on the corner of the pier the groin springs from; and drive a nail in the point of the groins meeting, on which fasten one end of a chalk line, straining it tight, slide it down the side of the straight piece, and it will form the groin, so as to stand perpendicularly over its base."

In *plates* C 8 and C 9 are shown Mr. Price's method of covering the parts of coved ceilings adjoining the angles, and also the covering of domes.

"Suppose M to be the plan of a ceiling, as *a b c d;* and in it, it is required to have a large frame, gulochi, or panel, as *g h i k.*

"First, produce some one side or end of the room, as N, let it be required to describe the curvilineal face of the cove. The extent of the end of the said room is *a, b, f, e;* and it is coved one-fourth of its height, as *m b.* The said frame or panel being *g h;* the quarter-circle, *m g,* is divided into eight equal parts, which are transferred to P; so that *m, g, h, l,* is the face of O, as stretched or extended out, on which any thing proposed to be described therein may be truly performed.

"In Q is shown the plan of a niche or dome: if a niche, let it be demanded to be veneered with walnut-tree, &c. If a dome, let it be required to be covered with boards or lead. Divide it into any number of parts, as here into nine; which transfer to S, as appears from *k* to *l.* Describe the section also, as R, being a quarter circle, which divide into any number of parts, as here into five, as is shown in the figure from *h* to *i;* which transfer in the plan Q, from *a* to *f;* middle some one division, as from 4 to 5; then take those distances from R, and transfer them to S, as from *f* to 5; so that each division is halved or middled, as *f a, f a,* &c.; on these lines place the distances from Q, as at *e d c b,* to 1, 2, 3, 4, in S; and these will form such curves as shall meet.

"N. B. The more parts it is divided into, the better and truer it will be performed.

"In T is shown the plan of an elliptical niche; its section is the same. In the plan T is shown the thickness of the ribs, (supposing it to be prepared for plastering,) as *i k l m n.* The manner of forming their several curves, as U, W, X, Y, Z, is best done with a trammel. Some of these ribs must be sloping, so as to require the mould to be shifted, as has been before shown in *plate* C 27.

"Such things as the construction and use of lines, are not conceived by every one; therefore, because I would omit nothing that I think would prove useful, I have inserted several more examples of tracery, the knowledge of which seems indispensably necessary.

"That of T is a regular semicircle, as *a, b, c;* from which is traced the raking (or rampant) on U; that of W is a regular ellipsis, as *d e f;* from which is traced the raking one X; that of Y is a regular segment, (or part of a circle,) as *g, h, i;* from which is traced the raking one Z; the manner whereof being so plain, a farther explanation seems needless.

"As to the particular use of these kind of arches, I must leave to the determination of the curious, and have nothing farther to say on that head, than that if occasion require either of them to be executed, there is no other true way to describe them.

"That of A is supposed to be the mitre bracket of a cove, whose projection is *b, c;* and the height thereof is *a, b;* the curve being a segment, or part of a circle, let it be demanded to trace a curve from it, as B, which shall be agreeable thereto, if applied as a common bracket; *e, d,* being its height as before, and *e, f,* its projection, first divide the given curve, being A, into a number of parts, or if you make points thereon promiscuously it is equal. From these divisions or points, drop perpendiculars to some straight line, as that of *a, c,* observing their meeting with the said line *a, c,* and for practice, take off all these distances on a lath (or rod) applying the proper end thereof to the projection of the common bracket B, being *f;* observing where the other end passes through the perpendicular line *e, d,* as at *g,* there raise perpendiculars (long enough) from the said points; then draw the line *d, f.* Lastly, transfer the distances, as from the straight line *a, c,* in A, to the figures to that of *d, f,* in B, which, no doubt, inspection will explain, more especially if the letters and figures be duly observed.

"And for variety view the figure A again, and admit it were the curve of a common bracket, let it be demanded to trace a mitre, or angle bracket from it, as C; *g, k,* being its height as before, and *h, i,* its projection, (as to the method of finding the projecture of either, no doubt but every one knows it,) take the line as *a, c,* in A, which in practice (as was before observed) I suppose to be on a rod or lath, with its divisions or points on it, and which transfer to C, as *g, k,* then draw the line *g, i;* lastly, from the said points on the line *g, k,* draw base lines, observing their meeting the line *g, i,* at which respective places raise perpendiculars, and transfer your several heights from A as before, observing to place each in its due position; and although the abundance of points should render this method somewhat confused, it may be evaded by making but few points, and driving nails therein; round which a straight lath being bent till it touch them all, the curve may be described with a pencil.

"N. B. This may serve as a general rule for all such curves as are not regular, or cannot be formed with a trammel, supposing either to be the given curve.

"That of D represents a common bracket for a plastered cornice, whose shape the plasterer ought always to be consulted for; let it be required to trace a corner or angle bracket from it, as E; first draw base lines from the respective angles, *a, b, c, d,* to the line *t, r,* as 1, 2, 3, 4, and also perpendiculars to the line *r, s,* as 5, 6, 7, 8; and (because an example for finding the projecture of the angle or mitre bracket may be required) observe to make *r u* equal to *r s*, so is *w s* the projecture of the said angle or mitre bracket, and the points will be *w*, *x*, *y*, *z*, so that by transferring this said line with its points, as before, to E, as also those of the height, as before, draw perpendicular and base lines, as no doubt inspection shows. Their meeting gives the shape of the bracket as desired; and this also may serve as a standard rule in any case. As to shifting this mould (in practice) so as to give the said angle bracket its true back, there seems to have been enough said in *plate* C 27.

"*Note.* The principal curve being formed on any plain superficies, it may be taken off on a lath, as before was observed, and by it the required curve may be described on a piece of slit deal, &c. of a width equal to what the arch rises from a straight line, with an allowance of wood capable of holding it together.

"That of F is a plan, or specimen of circular groins, whose extent is *a b c d*, an example of which may be seen in St. Clement's Danes, in the Strand, and in several other circular buildings, and in my opinion it is a curiosity worthy of regard. To find the plan of these groins do thus: divide from *a* to *d*, and from *a* to *b*, into a like number of parts, as into ten; the lines *a b*, and *d c*, being continued, meet in a point, as *g*, being the centre of the curves *a d*, and *b c*; divide also from *a* to *d*, into ten parts, which being drawn to the centre *g*, divides the line *b c* into the same number of parts equally; so that the meeting of these lines is the plan of the groins, as *a*, *e*, *c*, and *b*, *c*, *d*, and their upright is H, I, K, L, each being from the semicircle *a b*, in *g*, (being the principal curve;) as to the method whereby it is done enough seems to have been said of the foregoing examples to explain it; the letters of reference show plainly what part of the plan each curve belongs to, which being bent agreeable thereto, will strictly correspond with each other.

"N. B. If the principal curve had been a segment, (or part of a circle,) or an ellipsis, the method of performing would have been the same.

"This plan would be difficult in performance if required to be ribbed with timber for plastering; but if to be centred for brickwork, it would be much easier, because the centres might be placed as from the line *a b*, to that of *c d*, as in a common vault. The curves of each centre would be different on account of its being taper, but the height is equal; these centres should be boarded as others are, the boards requiring to be taper only.

"To make the groins so as to hang over the plan, the sides *a*, *b*, *c*, and *c*, *d*, *e*, must not be centred as usual, but have ribs agreeable to the plan, and placed horizontally, so that the boards would stand as it were upright, as in domes, which was explained in the foregoing plates, which show the method for finding the curvilineal form of any ceiling.

"N. B. The foregoing plates must be well understood in order to describe, on the centres first boarded, the accurate curve of the groin, which can be done by no other method than is here shown.

"If this plan were to be executed with ribs of timber for plastering, then the groins must be performed by the methods as will be hereafter inserted; for the twisted rails of staircases, on account of their plan not being a regular curve."

At the end of his work Mr. Price has given the following tables for the scantlings of timber.

A TABLE FOR THE SCANTLINGS OF TIMBER.

A Proportion for Timbers of small Buildings.

Bearing Posts of Fir.			Bearing Posts of Oak.		
Height.	Scantling.		Height.	Scantling.	
If 8 feet	4 in. sq.		If 10 feet	6 in. sq.	
10	5		12	8	
12	6		14	10	
Girders of Fir.			**Girders of Oak.**		
Bearing.	Scantling.		Bearing.	Scantling.	
If 16 feet....	8 in. × 11 in.		If 16 feet....	10 in. × 13 in.	
20	10 .. × 12½		20........	12 .. × 14	
24	12 .. × 14		24........	14 .. × 15	
Joists of Fir.			**Joists of Oak.**		
Bearing.	Scantling.		Bearing.	Scantling.	
If 6 feet....	5 in. × 2½ in.		If 6 feet....	5 in. × 3 in.	
9........	6½.. × 2½		9........	7½.. × 3	
12........	8 .. × 2½		12........	10 .. × 3	
Bridgings of Fir.			**Bridgings of Oak.**		
Bearing.	Scantling.		Bearing.	Scantling.	
If 6 feet....	4 in. × 2½ in.		If 6 feet....	4 in. × 3 in.	
8........	5 .. × 2¾		8........	5½.. × 3	
10........	6 .. × 3		10........	7 .. × 3	
Small Rafters of Fir.			**Small Rafters of Oak.**		
Bearing.	Scantling.		Bearing.	Scantling.	
If 8 feet....	3½.. × 2½ in.		If 8 feet....	4½in. × 3 in.	
10........	4½.. × 2½		10........	5½.. × 3	
12........	5½.. × 2½		12........	6½.. × 3	
Beams of Fir, or Ties.			**Beams of Oak, or Ties.**		
Length.	Scantling.		Length.	Scantling.	
If 30 feet....	6 in. × 7 in.		If 30 feet....	7 in. × 8 in.	
45........	9 .. × 8½		45........	10 .. × 11½	
60........	12 .. × 11		60........	13 .. × 15	
Principal Rafters of Fir.			**Principal Rafters of Oak.**		
Length.	Scantling.		Length.	Scantling.	
	Top.	*Bottom.*		*Top.*	*Bottom.*
If 24 ft.	5 in. × 6..	6 in. × 7 in.	If 24 ft.	7 in. × 8..	8 × 9 in.
36..	6½.. × 8..	8.. × 10	36..	8 .. × 9..	9 × 10½
48..	8 .. × 10..	10.. × 12	48..	9 .. × 10..	10 × 12

CARPENTRY.

A TABLE FOR THE SCANTLINGS OF TIMBER.

A Proportion for Timbers of large Buildings.

Bearing Posts of Fir.		Bearing Posts of Oak.	
Height.	Scantling.	Height.	Scantling.
If 8 feet	5 in. sq.	If 8 feet	8 in. sq.
12	8	12	12
16	10	16	16
Girders of Fir.		**Girders of Oak.**	
Bearing.	Scantling.	Bearing.	Scantling.
If 16 feet	9½ in. × 13 in.	If 16 feet	12 in. × 14 in.
20	12 .. × 14	20	15 .. × 15
24	13½ .. × 15	24	18 .. × 16
Joists of Fir.		**Joists of Oak.**	
Bearing.	Scantling.	Bearing.	Scantling.
If 6 feet	5 in. × 3 in.	If 6 feet	6 in. × 3 in.
9	7½ .. × 3	9	9 .. × 3
12	10 .. × 3	12	12 .. × 3
Bridgings of Fir.		**Bridgings of Oak.**	
Bearing.	Scantling.	Bearing.	Scantling.
If 6 feet	4 in. × 3 in.	If 6 feet	5 in. × 3½ in.
8	5½ .. × 3	8	6½ .. × 3½
10	7 .. × 3	10	8 .. × 3½
Small Rafters of Fir.		**Small Rafters of Oak.**	
Bearing.	Scantling.	Bearing.	Scantling.
If 8 feet	4½ .. × 3 in.	If 8 feet	5¼ in. × 3 in.
10	5½ .. × 3	10	7 .. × 3
12	6½ .. × 3	12	9 .. × 3
Beams of Fir, or Ties.		**Beams of Oak, or Ties.**	
Length.	Scantling.	Length.	Scantling.
If 30 feet	7 in. × 8 in.	If 30 feet	8 in. × 9 in.
45	10 .. × 11½	45	11 .. × 12½
60	13 .. × 15	60	14 .. × 16
Principal Rafters of Fir.		**Principal Rafters of Oak.**	
Length.	Scantling. *Top.* *Bottom.*	Length.	Scantling. *Top.* *Bottom.*
If 24 ft.	7 in. × 8 .. 8 in. × 9 in.	If 24 ft.	8 in. × 9 .. 9 in. × 10 in.
36 ..	8 .. × 9 .. 9 .. × 10½	36 ..	9 .. × 10 .. 10 .. × 12
48 ..	9 .. × 10 .. 10 .. × 12	48 ..	10 .. × 12 .. 12 .. × 14

"Although," says Mr. Price, "this table seems so plain, as to need no explanation, it may not be amiss to observe some particulars, such as that all binding or strong joists ought to be half as thick again as common joists: that is, if a common joist be given 3 inches thick, a binding joist should be 4½ inches thick, although of the same depth.

"Observe also, that if conveniency do not allow of posts in partitions being square, in such cases multiply the square of the side of the posts as here given, by itself: for instance, if it be 6 inches square, then as 6 times 6 is 36, consequently, to keep this post nearly to the same strength, find some number that shall agree thereto; as suppose the partition to be 4 inches thick, then let your post be 9 inches the other way, so that 9 times 4 is 36, being the same as 6 times 6; so that the strength is nearly the same, although being equal in its squares is best for strength.

"Posts that go to the height of two or three stories need not hold this proportion, because at every floor it will meet with a tie; admit a post was required 30 feet high, and in this height were three stories, two of 10 feet, and one of 8. Look for post of fir of 10 feet high in the table, their scantling is 5 inches square, that is 25 square inches; which double for the two stories. And take also that of 8 feet high, being 4 inches square, that is, 16 square inches, all which being added together, make 64 square inches; so that such a post would be 8 inches square. On occasion it may be lessened in each story as it rises.

"I do not insist that the scantlings of timber ought to be exactly as by this table expressed, but may be varied in some respects, as the workman shall see fit. The reason of its being inserted is, in consideration of the scantlings of timber, as formerly settled by act of parliament, and which, if compared, will prove the necessity and use of this table.

"As to plates on walls, or bressummers to support walls, I do not find that they can come into any regular proportion as the rest do, therefore must be left to discretion.

"And as I have herein described a great variety of the principal things requisite to be known by every carpenter, I shall conclude this part with my wishes that it may prove as useful as my earnest endeavours have been to make it so."

The author, whose works will next come under consideration, is Mr. Batty Langley. In his "Builder's Assistant," published in 1738, he has the following:

"*Of trussed partitions.*—When partitions have solid bearings throughout their whole extent, they have no need to be trussed; but when they can be supported but in some particular places, then they require to be trussed in such a manner that the whole weight shall rest perpendicularly upon the places appointed for support, and nowhere else; as partitions are made of different heights, to carry one, two, or more floors, as the kinds of buildings require.

"The first things to be considered in works of this kind, is the weight that is to be supported; the goodness and kind of timber that is to be employed; and proper scantlings necessary for that purpose.

"The strength of timber in general is always in proportion to the quantity of solid matter it contains. The quantity of solid matter in timber is always more or less, as the timber is more or less heavy; hence it is, that all heavy woods, as *oak, box, mahogany, lignum vitæ*, &c. are stronger than *elder, deal, sycamore*, &c. which are lighter, or (rather) less heavy, and indeed, for the same reason, iron is not so strong as steel, which is heavier than iron; and steel is not so strong as brass or copper, which are both heavier than steel. To prove this, make two equal cubes of any two kinds of timber, suppose the one of *fir*, the other of *oak*: weigh them singly, and note their respective weights; this done, prepare two pieces of the same timbers, of equal lengths, suppose each 5 feet in length, and let each be tied up as nearly square as can be, but to such scantlings, that the weight of a piece of *oak* may be to the weight of the piece of *fir*, as the cube of *oak* is to the cube of *fir*; then those two pieces being laid horizontally hollow with equal bearings, and being loaded in their middles with increased equal weights, it will be seen, that they will bend or sag equally, which is a demonstration that their strengths are to each other, as the quantity of solid matter contained in them.

"As the whole weight on partitions is supported by the principal post, their scantlings must be first considered; and which should be done in two different manners, viz. first, when the quarters, commonly called *studs*, are to be filled with brickwork, and rendered thereon; and lastly, when to be lathed and plastered on both sides.

"When the quarters are to be filled between with brickwork, the thickness of the principal posts should be as much less than the breadth of a brick, as twice the thickness of a lath; so that when those posts are lathed to hold on the rendering, the laths on both sides may be flush with the surfaces of the brickwork; and to give these posts a sufficient strength, their breadth must be increased at discretion; but when the quarters are to be lathed on both sides, or when wainscotting is to be placed against the partitioning, then the thickness of the posts may be made greater at pleasure. The usual scantlings for principal posts of *fir*, of 8 feet in height, is 4 or 5 inches square; of 10 feet in height, 5 or 6 inches square; of 12 feet in height, 6 or 7 inches square; of 14 feet in height, 7 or 8 inches square; of 16 feet in height, from 9 to 10 inches square. But these last, in my opinion, are full large, where no very great weight is to be supported. As *oak* is much stronger than *fir*, the scantling of *oak-posts* need not be so large as those of *fir*; and therefore the scantlings assigned by Mr. Francis Price, in his treatise of carpentry, are absurd; as being much larger than those that he has assigned for *fir-posts*. To find the just scantling of oaken posts, that shall have the same strength of any given *fir-posts*, this is the rule:

"As the weight of a cube of *fir* is to the weight of a cube of *oak* of the same magnitude, so is the area of the square end of any *fir-post*, to the area of the end of an oaken post; and whose square root is equal to the side of the oaken posts required.

"The distances of principal posts is generally about 10 feet, and of the quarters about 14 inches, but when they are to be lathed on both sides, the distances of the quarters should be such as will be agreeable to the lengths of the laths, otherwise there will be a very great waste in the laths. The thickness of ground plates and raisings are generally from 2½ inches to 4 inches, and are scarfed together as *plate* C 29, *figs*. 1, 2, 3, 4, 5, 6, 7, 8.

"*Of naked flooring*.—The principal things to be observed in naked flooring are, first, the disposition of girders, or manner of placing them in the most secure and advantageous manner. Secondly, their scantlings; and lastly, the manner of trussing them, when their lengths require it.

"There are some carpenters, who insist that girders should be laid on strong lentils over windows, and who allege that girders being laid on lentils in piers, the piers are endangered at the decay of those lentils. Others insist, that it is best to lay girders in piers, as being the most solid bearings, and that if sound oaken lentils are laid under them, they will endure as long as the brickwork will remain sound.

"In buildings, whose piers are narrow at the renewing of lentils, the piers will be endangered in both these cases; for lentils laid over windows must be laid into the piers, on both sides of a window, and which, when taken out, will make large fractures, that will be very little less dangerous than the other, and therefore I shall submit this point to the discretion of the workmen.

"Lentils laid in piers between windows, for the support of girders, should have their lengths equal to the breadths of the piers: and those laid in party-walls, or gable ends of building, should be equal in length to the distance that is contained between every two girders. The thickness of lentils should always be equal to the height of two or three courses of bricks, and their breadth into a brick's length; so that in every of those particulars, they may be conformable to the brickwork in which they are placed, and to that which is raised on them. And for the better disposing of the weight imposed on girders, lentils should always be firmly bedded on a sufficient number of short pieces of *oak*, laid across the walls, vulgarly called templets, which are of excellent use.

"Let girders be laid in piers, or in lentils over windows, it will, in both these cases, be commendable to turn small arches over their ends, that in case their ends are first decayed, they may be renewed at pleasure, without disturbing any part of the brickwork; and for their preservation anoint their ends with melted pitch and grease, viz. of pitch 4, of grease 1; and indeed, were lentils to be covered with pitch and grease also, it would contribute very greatly to their duration.

"It is always to be observed, that the shortest girders bend down, or sag, as workmen term it, the least, and therefore it is always best to lay girders over the narrow parts of rooms, and whose ends should always have, each, at least 14 inches bearing in the walls, excepting in small buildings, where the front, &c. walls are but a brick and half in thickness, when, to prevent the ends of the girders from being seen without side, their bearings cannot much exceed 11 inches.

"It is also to be observed, that girders be so disposed of, that the boards of every floor be parallel throughout the whole floor; for it is as disagreeable to the eye to see the joints of boards in the same floor lie different ways, as it is to see steps out of one room into another, which should always be avoided.

"In the carrying up the several walls of buildings, it should be carefully observed, to lay in bond timbers on templets, as aforesaid, at every 6 or 7 feet in height, cogged down, and braced together with diagonal pieces at every angle, which will bind the whole together in the most substantial manner, and prevent fractures by unequal settlement.

"The distances of girders should never exceed 12 feet, and their scantlings must be proportioned according to their lengths; as by experience it is known, that a scantling of 11 inches, by 8 inches, is sufficient for a *fir* girder of 10 feet in length, the area of whose end is 88 inches, it is very easy to find the proper scantling for a girder of any greater length, suppose 20 feet, by this rule: as 0 feet, the length of the first girder, is to 88, the area of its end, so is 20 feet, the length of the second girder, to 176, the area of its end.

"Now, to find its scantlings, that, being multiplied into each other, shall produce 176 inches, the area found, one of them must be given, viz. either the depth, or the thickness. In this example, the given depth shall be 12 inches; therefore divide 176 by 12, and the quotient is 14 inches and two-thirds, which is the other scantling or breadth required.

"To prevent the sagging of short girders, it is usual to cut them *camber*, that is, to cut them with an angle in the midst of their lengths, so that their middles shall rise above the levels of their ends, as many half inches as the girder contains times 10 feet. And indeed, girders of the greatest length, although trussed, should be cut camber in the same manner.

"The next in order are *joists*, of which there are five kinds, viz. *common joists*, *binding joists*, *trimming joists*, *bridging joists*, and *ceiling joists*. First, common joists are used in ordinary buildings, whose scantlings in *fir* are generally made as follows, viz. joists of 6 feet in length, to be 6½ by 2½; of 9 feet, 6½ by 2½; of 12 feet, 8 by 2½. But in large buildings the scantlings are made larger, where it is common to make joists of 6 feet, 5 by 3; of 9 feet, 7½ by 3; of 12 feet, 10 by 3.

"As *oak* is much heavier than *fir*, it is customary to make the scantlings of *oak joists* larger than those of *fir*; but I believe it to be entirely wrong, for the reason before given, relating to the strength of timber. Secondly, *binding joists* are generally made half as thick again as *common joists* of the same lengths, and are framed flush with the under surfaces of girders, to receive the *ceiling joists*, and about 3 or 4 inches below their upper surfaces, for to receive the *bridging joists*; so that the upper surfaces of the *bridging joists* may be exactly flush or level with the girder to receive the boarding. In *plate* C 29, *figs.* 11 and 12, A represents the section of a girder; *b b*, &c. parts of two *binding joists*, tenoned into the girder; *a a*, &c. the ends of *bridging joists*; *e e* boarding on the bridgings; *d d*, &c. mortises in the *binding joists* to receive the tenons of *ceiling joists*; as also are the mortises *b c*, *b c*, &c. But these last are those which are called pulley mortises, into which the *ceiling joists* are slid. To understand this more plainly, the figures *f f f f* are added, which represent the sections of so many *binding joists*; *g g*, &c. the sections of small joists between them; *x x* a side view of a *bridging joist*, and *h h h ceiling joists*, tenoned in the *binding joists*, flush with their bottoms, as aforesaid, to receive the lath and plaster. The distance that *binding joists* should be laid at, should not exceed 6 feet, though some lay them at greater distances, which is not so well, because the *bridging* and *ceiling joists* must be made of larger scantlings to carry the weights of the ceiling and boarding, and consequently a greater quantity of timber must be employed. But, however, as this particular is at the will of the carpenter, I shall only add, that the scantlings for bridgings of *fir*, having 6 feet bearing, should be 4 by 3 inches; those of 8 feet bearing, 5½ by 3; and those of 10 feet, 7 by 3. Their distance from each other is generally about 12 or 14 inches.

The *figs.* 9 and 10 are examples of floors made of short lengths, which I have given for the diversion of the curious.

"*Of roofs.*—As the common method of framing the trusses of principal rafters of large roofs, is to lay the whole weight of the beam and covering upon their feet, they therefore should be secured at the beam with iron straps, to prevent their flying out, in case that their tenons should fail; but as I apprehend this method was capable of improvement, I therefore considered that if under the lower parts of principal rafters there be discharging struts framed into the beams and prick posts, they will discharge the principal rafters from the greatest part of the whole weight.

"As I have thus given a brief explanation of these several sorts of trusses for straight rafters, it will be necessary to say something of the scantlings of beams and rafters before I proceed any further.

Beams.

Length. Feet.	Scantling. Inches.
30	6 × 7
45	9 × 7
60	10 × 8½
75	10½ × 10
90	12 × 10½

Principal Rafters.

Length. Feet.	Scantling at Top. Inches.	Scantling at Bottom. Inches.
24	5 × 6	7 × 6
36	7 × 6	9 × 7
41	9 × 7	10 × 7½
60	10 × 7½	10 × 9
72	10 × 9	11 × 9½

Small Rafters.

Length. Feet.	Scantling. Inches.
8	4½ × 3
10	5 × 3
12	6 × 3

"*How to lay roofs in ledgment. Plate* C 30.—This example is of an irregular roof, whose several angles are bevel, wherein *t s a q* is the plan, 1 1, *e*, 1 2, *k*, 1 3, *l*, and 1 4, *o*, are the beams over which the principal beams are to stand.

"Let the line *c n* be the base of the ridge, which is to be placed at pleasure, and let *t c*, *a c* and *n s*, *n q* be the bases of the four hips; on the points *c g k n* erect the perpendiculars *c d*, *g f*, *k i*, and *n m*, which make each equal to the height of the pitch, and draw the lines *d* 11, *d e*; *f* 12, *f h*; *i* 13, *i l*; *m* 14, *m o*; which will be the lengths of the several principal rafters. At the points *c* and *n*, erect the lines *n r*, *n p*, and *c v*, *c b*, perpendicular to the bases of the hips, and each equal to the heights of the pitch, and draw the lines *t v*, *a b*, and *r s*, *p*, *q*, which are the lengths of the several hip rafters; make *s x*, and *x q*, the sides of the scalenum triangle *s x q*, equal to *r s* and *p q*, also *t w* and *w a*, equal to *t v* and *a b*, which will complete the ledgment of the ends. Make 1 4 *z* equal to the principal rafter 14 *m*, and *s z* equal to the hip *r s*; also make *o z* equal to the principal rafter *o m*, and *q z* equal to the hip *p q*; also make *e y* equal to the principal rafter *d e*, and *a y* equal to the hip *w a*; also make 8 *y* equal to the principal rafter *d* 8, and *t y* equal to the hip *t v*. Make *y* W and *y* Y each equal to *c g*; also W X and Y Z each equal to *g k*; also X *z* and Z *z* each equal to *k n*. Draw the principal rafters 12 W, 13 X, and *h* Y, *l* Z. Lastly, draw in the purloins 21, 22, 20, 23, 24, at discretion, and they will complete the whole ledgment, as required.

"*Of the manner of describing angle brackets and hip rafters in polygonal roofs.*—As brackets are used very frequently in buildings, I shall therefore show how to find the curvature of any angle bracket by one general rule, as follows:

"Let A, in *fig.* 1, *plate* C 31, be a front bracket given, whose height is *d b*, its projection *a b*, and its curve a caveto; and let the shaded parts *b d* represent an angle of a building, against which the cove is to be fixed.

"Draw the lines *a h* and *h i* parallel to the two sides of the building, at the distance of the projection of the front bracket, and draw 7 *d* the base of the front bracket, and *f h* the base of the angle bracket; divide 7 *c* into any number of equal parts, as at the points 6, 5, 4, 3, 2, 1, and draw the ordinates 6, 8; 5 9; 4, 10; 3, 11, &c., divide *h f* into the same number of equal parts as 7 *c* is divided, which will be done by continuing the ordinates of 7 *c*, until they meet *h f* in the points 6, 5, 4, 3, &c. whereon erect the ordinates 1, 13; 2 12; 3, 11, &c. equal to the ordinates 1, 13; 2, 12; 3, 11, &c. on the line 7 *c*; and through the points 13, 12, 11, 10, 9, 8 *l*, trace the quarter of an ellipsis, which is the curve of the angle bracket required.

"By the same rule, all other kinds of angle brackets may be described.

"The curvatures of hip rafters to polygonal roofs, that is, those whose plans are polygons, as the *figs.* 3, 4, 5, 6, *plate* C 31, are also found by transposing the ordinates of a principal rafter (which must be given) upon the base of a hip rafter.

"Suppose, in *fig.* 3, *a d* to be the base, over which the caveto principal rafter *c d* is to stand, and let *a e* be the base of a hip rafter. Divide *a d* into equal parts, and draw the ordinates 2, 1; 4, 3, &c. on the line *a*, *d*; divide *a e* in the same manner as *a d*, and on the line *a e* draw the ordinates 1, 2; 3, 4; 5, 6, &c. and from the point *b*, through the points 2, 4, 6, 8, &c. trace the curve of the hip rafter as required. In the same manner in *fig.* 5, the principal rafter *c d* being given, the hip rafter *b e* is found; as also are the hip rafters *b e* in *fig.* 6, and *c e* in *fig.* 7, the principal rafters being first given.

"*To cover or line the head of a niche.* *Fig.* 4, *plate* C 31.—Let *a f c* be the plan of the head of a semicircular niche, and complete the circle *a f c d*. Draw the diameters *a b c*, and *d b f*, continued out towards *e* at pleasure. Make *f r*, and *f s*, each equal to one-fourth of *a f*; then *f s* will be equal to half *a f*, and draw the lines *h b* and *s b*. Divide *b d* into any number of equal parts, and draw the ordinates 1, 8; 2, 9; 3, 10, &c. and on the points where those ordinates cut the semidiameter *b d*, with the radius of each semiordinate, describe semicircles, as the dotted semicircles in the figure. Make *e p* equal to the curve *a f*. Make *f p* equal to *a* 1, *f o* equal to *a* 2, *f n* equal to *a* 3, *f m* equal to *a* 4, *f l* equal to *a* 5, *f k* equal to a 6, and *f q* equal to *a* 7. On the point *e* describe the arches 13, 14; 11, 12; 9, 10, &c. Bisect the half part of each of the dotted semicircles, as *f c* in *i*, 1 8 in 2, 3 9 in 4, 5 10 in 6, 7 11 in 8, 9 12 in 10, 11 13 in 12, and 13 14 in 14. Make *f h*, and *f g*, each equal to half the arch *f i*; *p* 1 and *p* 2, each equal to half the arch 1 2; *o* 3, and *o* 4, each equal to half the arch 3 4; and so in like manner, *n* 5, and 5 6, to half the arch 5 6, &c. From the point *e*, through the points 12, 11, 9, 7, &c. and 14, 12, 10, &c. trace the curves *e h* and *e g*; then four such pieces, as *e h g*, will cover the head of the niche, as required.

"*Note*. If the niche have to be lined, then the diameter of the circle, being made equal to the inside diameter of the niche, the lining may be found in the same manner. The same method is also to be used, for the covering or lining of a semielliptical headed niche, as is plainly seen by *fig*. 8, where every of the same operations is performed on the plan of an ellipsis, and where *e h s* is the covering for one-eighth of the whole hemispheroid.

"As sometimes the niches are made semipolygonal, it is necessary to show their covering also, and which is of great use in the covering of polygonal roofs, as those of banqueting-houses, turrets, &c.

"Let *fig*. 5, *plate* C 31, be a plan given, whose principal rib or rafter is *c d*, and hip *b e*. Make the length of *k f* equal to the curved length of *c d*, and draw the lines *g a* and *h a*. Draw the ordinates to the principal rib *c d* on its base *a d*. Make the several distances *k i*, 1, 2; 2, 3, on the line *k f*, equal to the several parts of the principal *c d*, as they are divided by the ordinates, making *k i* equal to the first part from *d*, 1, 2, equal to the second part, 2, 3 equal to the third, &c. Divide *k a* in the same proportion as *a d*, at the points 1, 2, 3, &c. through which draw right lines parallel to *g h*, to terminate at the lines g *a* and *h a*; also through the points 1, 2, 3, in the line *k f*, draw right lines at pleasure, and parallel to *g h*. Then making the lines 1, 7; 2, 8; 3, 9, &c. on the line *k f*, equal to the lines 1, 7; 2, 8; 3, 9, &c. on the line *k a*; and from *f*, through the points 13, 12, 11, &c. to *h*, trace the curve *f h*. In the same manner trace the curve *f g*. Then the piece *f g h*, being bended up, and laid on the two hips that stand over the line *g a* and *h a*, will be the covering for that side of the roof or niche, as required.

"*Note*. The coverings to the two ogee roofs, *figs*. 6 and 7, and the caveto roof, *fig*. 3, are found in the same manner, as is evident to inspection.

"*Of straight, circular, and elliptical arches in circular walls. Plate* 32.—The first work to be done is the making of the centres to turn these kinds of arches upon, which may be thus performed. Let G H I K be the plan of a circular building, and at *fig*. 6 it be required to make a centre for a semicircular arch to the window, whose diameter without is *a d*, and within *n m*. Bisect *a d* in *f*, and describe the semicircle *a p d*. Divide *a d* into any number of equal parts at the points 6 4 2, &c. and draw the ordinates 6, 6; 4, 4; 2, 2, &c. Divide *n m* into the same number of equal parts, and make the ordinates 6, 5; 4, 3; 2, 1, &c. equal to the ordinates 6, 6; 4, 4; 2, 2, &c. and through the points 5 3 1 *k*, &c. trace the curve *n k m*, then *a p d* and *n k m* will be the two ribs for the centre: this being done, place the ribs perpendicular over the lines *a d* and *n m*, and cover them, as centres usually are, and then applying the edge of a plumb-rule to the divers parts of the inside and outside of the window's bottom, the top of the rule will give the several points at which the inside and outside of the covering is to be cut off, so as to stand exactly over the inside and outside of the building, and then the centre will be completed as required.

"*To divide the courses in the arch of this window.*—On a flat panel, &c. draw a line, as *b e*, *fig.* 7, make *a f o* equal to the curve *a c d*, also make *a b* and *o e* each equal to the intended height of the brick arch. Make *f p* in *fig.* 7, equal to *e p* in *fig.* 6, also make *a b* and *d e* in *fig.* 6 each equal to *b a* in *fig.* 7, then the points *b* and *e* will be the extremes of the arch. Make *p r* in *fig.* 7 equal to *b a* the given height of the arch, and through the points *b r e* and *a p o* describe two semiellipses, which divide into courses as before taught, and which will be the face of the arch required.

"*To find the angles or bevels of the under part of each course.*—Continue the splay-backs of the window *m d* and *n a* until they meet in F. On F, with the radius F *n* and F *a*, describe the arches *n y v* and *a f s*, making *n y v* equal to the girt of the arch *n k m*. Make *n* 6, *n* 4, *n* 2, *n y*, &c. on the arch *n y v*, equal to *n* 6, *n* 4, *n* 2, *n y*, &c. on the curve *n k m*, and draw the lines 6 F, 4 F, 2 F, *y* F, &c.; make the ordinates 6, 5; 4, 3; 2, 1; *y x*, &c. on the lines 6 F, 4 F, &c. equal to the ordinates 5, 6; 3, 4; 1, 2; *h i*, &c. on the line *n m*, and through the points 5, 3, 1, *x*, &c. trace the curve *v x m*. In the same manner transfer the ordinates 5, 6; 3, 4; 1, 2; *c*, *f*, &c. on the line *a d* to the arch *s f a*, as from 5 to 6, from 4 to 3, &c. and trace the curve *s c a*; and then will the figure *n y v s c a* be the soffito of the window laid out, and which being divided into the same number of equal parts, as the under part of the arch *a p o*, *fig.* 7, and lines drawn to the centre F, as is done in *fig.* 2, to the centre A, by the lines 2, 2, 2, &c. those lines will give the bevel of every course in soffito, as required. *Fig.* 5 is another example of a semielliptical arch, whose front is *fig.* 4. Also *fig.* 2 is a third example of a scheme arch, whose front is *fig.* 1. And *fig.* 8 is a fourth example of a straight arch, which in general are performed by the aforesaid rule.

"*To find the curvature of every course in front.*—Suppose the rusticated semicircular-headed window, *fig.* 9, be standing in the side of a cylinder, whose sides are the lines Q T and P V, continue out the sides of each rustic until they cut the sides of the cylinder in the points Q R S T and N O P, &c. then the lines Q N, R O, Q N, &c. will be transverse diameters of so many ellipses, whose conjugate diameters are each equal to the diameter of the cylinder, which describe as in *fig.* 10, and draw their conjugate diameters *k l*, *i m* and *n o*: make the distances *o* 5, *m* 3, *l* 1, on each ellipsis, equal to *a g* the semidiameter of the window, *fig.* 9, also make the distances 5 6, 3 4, 1 2, on each ellipsis, equal to *g* 10 the height of the rustic arch; then the segments of the several ellipses, 5 6; 3, 4; 1, 2; at Z X A, will be the curves of the several courses, as required.

"*Fig.* 3 represents the manner of covering the outside of a cone, the arch *c a* being made equal to the circumference of the circle *e*, which is equal to the base of the cone: this figure is exhibited here to show, that the soffito of a semicircular-headed window, whose splay is continued all round, is no more than the lower superficies of a semicone; for if the splay was continued in every part, it would meet in a point, as the lines *k d h* and *i e h*, *fig.* 8, and form a semicone as aforesaid."

Having concluded our extracts from Langley's "*Builder's Complete Assistant*," it may be, perhaps, advisable to state, that, though we are indebted to Mr. Langley for some useful discoveries, as that of the extension of the superficies of polygonal roofs with curvilinear rafters, and the covering of the frustum of a semicone for a soffit in a straight wall, the axis of the cone being at right angles to the plane of the wall, yet many of his deductions are very erroneous.

What he has said relative to the strength of timber being in proportion to the quantity of solid matter it contains, is void of all principle, as the very reverse is not unfrequently proved to be the case: and with respect to his idea, that the relative scantling of oak and fir posts may be found by the rule, that "as the weight of a cube of fir is to the weight of a cube of oak of the same magnitude, so is the area of the square end of any fir post to the area of the end of an oaken post, and whose square root is equal to the side of the oaken post required," it is no less defective and erroneous in principle.

Plate C 29, *figs.* 1, 2, 3, 4, 5, 6, 7, 8, exhibit various methods shown by him of scarfings for raisings, plates, &c. Of these, which bear a strong resemblance to those exhibited in Smith's work, *figs.* 1, 3, and 5 are the only fair examples. Of *fig.* 6, and its correspondent *fig.* 8, it may be said, that very few carpenters would work it true; indeed, carpenters, in order to save themselves a little trouble, are but too apt to dish or hollow out mortises, instead of paying that degree of attention to them which their obvious importance demand. In the same plate, *figs.* 9 and 10 exhibit two examples of naked flooring, wherein the timbers are so arranged as mutually to support each other. This kind of flooring had its origin in Italy, and was at one time practised in England, but being found disadvantageous has been discontinued. *Figs.* 11 and 12 represent the section of a girder. In *fig.* 12 the joists, *g*, add considerably to the expense without being of adequate utility.

In *plate* C 30, he has given us a very fair specimen of laying roofs in ledgment, in which he differs from Price in the disposition of the rafter feet.

In *plate* C 31, *figs.* 1 and 2, are shown his methods of tracing angle brackets; and *figs.* 3, 4, 5, 6, 7, 8, his methods of covering niches or domes.

In *plate* C 32, he has attempted to exhibit the construction of semicircular, semielliptical, scheme, and straight arches in circular walls; but most of them are void of principle, defective, and full of redundant lines.

In the "*Builder's and Workman's Treasury of Designs*," Mr. Langley has an appendix, consisting of 14 plates, on the geometrical principles of roofing, from which we shall transcribe the following:—

Plate C 33, *fig.* 1, "*a b c d*, plan of the raising; *e f*, the central line; *i m l o*, base lines of the outward principals; *a g*, *g c*, *b h*, *h d*, base lines of the hips; *g h*, base of the ridge, *k n*, base line of the middle pair of principals; *e g h f*, base lines of single principals, which meet the hips in the points *g h*; *i*, *k*, *l*, *m*, *n*, *o*, dovetailed mortises in the raising to receive the dovetails or calks, 1, 2, 3, of the beams A B C; *p p*, dovetailed mortises to receive the angle braces, as *p p* in *fig.* 3; D, a calk or dovetail at large; E, the dovetail mortise in the raising to receive the dovetail or calk D.

"*Fig.* 2. *To find the lengths of the principal and hip rafters.*—Make *d b* equal to the breadth of the building, and *a c* equal to the height of the pitch; then *a b*, *a d*, is the length of a pair of principals, and *d a c* the angle of the top, and *a d c* the angle of the foot of the principal *a d*.

"*Fig.* 3, *a b c d*, plan of the raising; *f g*, *f g*, beams calked down on the raising; *p p*, *p p*, &c. angle braces calked down in like manner; *a e*, *b e*, *c e*, *d e*, dragon pieces to receive the feet of the hip rafters; *a h*, *b h*, *c h*, *d h*, hip rafters; *a h k*, the angle of the top, and *h a k*, the angle of the foot of the hip, *a h*.

"*Fig.* 4. *To find the angle of the back of a hip in any regular or irregular building.*—*Rule.* On any part of its base line, as *c*, draw a right line at right angles, as *f g*; set up the hip, as *h b*, and from *c* draw *c d* perpendicular to the hip *h b*; make *c e* equal to *c d*, and draw the lines *f e*, *e g*; then the angle *f e g* is the angle of the back required."

Leaving Batty Langley, we shall next proceed to Pain's "*British Palladio*," and extract the following observations on groins and angle brackets:—

"*Of groins and angle brackets.*—*Plate* C 34. *Fig.* A is a vault to be groined, *a* is the given rib, *b* the jack-ribs, which cut on the body range, when set and boarded in, as shown on the given rib *a*. There is one whole rib stands between the piers and two jack-ribs, which is plain to inspection: *c* and *d* show the tracing of the jack-rib. Divide half the base line *c* into four parts, and the last one at the pier into two parts, and draw those parts to the diagonal line *e*; then draw them at right angles, across the base line *a*; then take off the ordinates 1, 2, 3, 4, 5, 6, 7, 8, from the arch *c*, and set them on 1, 2, 3, 4, 5, 6, 7, 8, from the base line *d*; then tack in nails at points 2, 4, 6, 8, 10, and bend a thin slip round, and mark as that curve directs; that will be the mould for the jack-ribs. When the body-range of the rib *a* is set and boarded in, a mould must be made to get the angle or place of the jack-ribs. Divide half the arch *c* into five parts, and run ten of those parts from *a* to *b*, which will be the length of the whole arch stretched out. Then divide half the arch *d* into five parts, and draw them from the arch line to the base line, as 4, 1, 3, 2, 2, 3, 1, 4, 2, 5. Then take those parts from the base line *d*, and set them from *b* to *d*, and from *c* to *d* the same parts; for the line *b c* is equal to the base line *d*: those lines, drawn to meet each other, form the curve *b e f*; so the shaded part *e b* is a mould to be bent over the body range from the centre 1 to the pier 2, mark it by, and it will give the angle line exactly true; then turn the mould, and mark all the angles in the same manner. This method will find the angles of any groin, regular or irregular: the ribs set a foot or 14 inches apart on temporary posts and plates, on wedges.

"*Fig.* B is a groin ceiling. The hips are traced from the given arch *e*, which is an ellipsis; the hips are got out and set, and the jack-ribs are cut and nailed between them, as represented in the plan, *fig.* B, which is plain to inspection.

"*Fig.* C is an angle bracket, at an external angle; and *fig.* D is an angle bracket at an internal angle, which are traced by ordinates, the same as the groin: *fig.* E, *plate* C 35, an angle bracket for a plaster cornice, at an internal angle; *fig.* F an external angle, allowing one inch for lath and plaster; *fig.* G an angle bracket, at an acute angle; *fig.* H at an obtuse angle.

"*Plate* C 36. *Fig.* I is an elliptical skylight, showing the plan of the ribs and horizontal bars, as they are drawn from the section of the bar in the rib to the base line of each rib, and transferred to the plan, which gives the moulds for the horizontal bars, as *m m*. The ribs are all traced from the rib *a*, which stands on the conjugate diameter; the rib *b* stands on the transverse diameter; the rib *c d e* stands on the quarter, as *c d e*. The section of the bars, on the ribs, shows how big the wood should be to get the bars out; for they are circular both ways, which some are not aware of.

"*Fig.* K is one quarter of the plan, showing the plan of the ribs, and the wood that must be taken off from the concave and convex edges.

"*Plate* C 37. *Fig.* L is a pentagon, to be covered with a domical roof; the hip *b* is traced from the given rib *a*, the same as the angle bracket, which is plain to inspection. To find the backing of the hip, draw the plan of the hip at one of the angles to the proper size, and that will show the wood that is to come off, as 1, 2; set on the bottom of the hip, as 1, 2; tack in a nail at 2, and apply the bottom of the hip mould to the nail, and top out to nothing, and mark it by, which will show the wood that is to be taken off. The same rule will do for the caveto roof, *fig.* N, whose plan is a hexagon.

"*Fig.* P is an octagon plan, to be covered with an ogee roof, or *cima recta*. The hips are all traced from the given ribs. The backing of this hip must be set on at top and bottom, as 1, 2, 1, 2, and nails tacked in at 2, 2, and the mould laid to the nails, and mark by, which will show the wood to come off. The wood to come off in the middle will be much less than at top and bottom.

"*Fig.* M is a hexagon, to be covered with a *cima reversa*, or bell-roof, so called by some. The backing of that hip must be set on in the middle, as 1, 2, on a line drawn parallel with the base line of the hip; then set the hip mould against that nail, and hold the mould so that the top and bottom ends are on exactly alike; mark it by, and that will show the wood to come off, which will be much less at bottom and top than it is in the middle.

"*Fig.* O shows the method for drawing any polygon figure to a given side. Suppose *a b* to be a side given: make a radius of *a b*, and describe the arch *a* 6 and *b* 6; then divide *a* 6 into six equal parts, and turn one down on the perpendicular line to 5, and that will be the centre for drawing a circle touching the points *a* and *b*, that will receive the side *a b* five times. The centre 6 will draw a circle touching the points *a*, *b*, and will receive the side *a b* six times; and so on to twelve sides, the circles to touch the points *a*, *b*, &c.

"*Fig.* Q shows the method for drawing an ellipsis, or oval, as it is commonly called.—Suppose *f b* to be the length, or transverse diameter, and 1 2 to be the height, or semiconjugate diameter; make *b a* equal to 1 2; then divide *a* 1 into three parts, and turn one over to *c*; then make *d* 1 equal to *c* 1; with *c d* bisect *e*, and draw the lines *e c* 3, and *e d* 4; then set the compasses at *d*, and draw the arch *f* 4; then set at *c*, and draw *b* 3; then set the compasses at *e*, and draw the arch 4, 2, 3; which completes the semiellipsis. This method will draw an ellipsis to any given length and breadth.

"*Plate* C 38. *Fig.* A is a pentagon, to be covered with a domical roof. To find the curve of the boarding, divide the girth or curve of the rib on the back into four parts, and drop them to the base line of the rib; then set the compasses in the centre of the plan, and draw the dotted lines 1 . 1 . 3 . 3 . 5 . 5; then, on the other half of the cant, draw the straight lines 1, 2, 3, 4, 5, 6; then stretch out the curve line of the rib, as *c d*, and draw the lines 1, 2, 3, 4, 5, 6, across those divisions; then take them off the plan, and set them at right angles with the line *c d*, as 1, 2, 3, 4, 5, 6, which gives one edge; then set them on the other side, as 1, 7, 2, 8, 5, 9, and tack in nails at *d* 6, 4, 2, *e*, and at 9, 8, 7, *f*; then bend a thin slip to the nails, and mark as that curve directs, which will be the edge of the covering or boarding. The covering or boarding of *figs.* B, C, D, E, and F, are found in the same manner; which is very plain to inspection, the girth of each rib being stretched out, and the parts set on as above directed.

"*Note.* The bottom part of the ribs B C D, must be divided into two parts, as you see on the plan.

"*Fig.* F shows the method for getting out the veneer, or cover of an elliptical niche on a dome. Stretch out the girth of each rib, as *a*, *b*, *c*, *d*, *e*, and proceed as directed in *fig.* A. The ribs *a*, *b*, *c*, *d*, *e*, are traced from the given rib *a*, which is a quarter of a circle, or half the rib that stands on the conjugate diameter.

"For gluing small niches, as *fig.* E, get the staves the full length, and saw them down to the spring to the thickness of the veneer, and bend them on a templet to the curve, and back them, as at *a*. Then the joints will be straight, and may be glued up, the same as a column. Suppose a cornice to go round at the spring of the niche, as at *c*, and one on the inside, as at *d*; draw the face line of the cornices to the centre of the body at *e* and *f*, and on that centre draw the arch lines *a b* and *e d*, which is the top edge of the cornices, and will be straight when bent round the body at the spring of the niche.

"*Plate* C 39. *Fig.* G is a circular flewing soffit in a circular wall. Continue the flewing of the jambs till they meet at *c*; then take the radius *c a*, and draw the arch lines *a b* and *c d*; then divide the arch lines of each into eight parts, and run four of those parts from 2 to *a*, and from 2 to *b*; then take one of the parts of the lesser arch, and run them from 1 to *c*, and from 1 to *d*, which is the soffit Q stretched out. Set the compasses at 1, on the inside of the plan; extend to 7, and describe the arch 7, 4; raise the perpendicular 11 4 to meet the arch line, and draw the flewing line 3 4; and by the same rule all the other flewing lines are found, as in *figs.* I and K, the length of these flewing lines gives the width of the soffits *t* and *s*, which may be proved by the plan; for, if the width of the soffit was to be taken on the plan in the direction of the lines dropped from the two arches, it would be too narrow, as much as is shown by the two arch lines on the inside of the plan of the soffit, for *fig.* H. The width may be taken from the lines drawn across the plan, by reason of the jambs standing square to the chord line of the opening, &c.

"*Fig.* H is a circular soffit in a circular wall, the jambs standing square to the chord line of the opening of the door or window. Draw the chord line of the arch 8 8, and the chord line 9 9, just to touch the plan of the wall at 3; then divide the arch line of the soffit into eight parts; draw the line 8 8, and take one of those eight parts in the compasses, and run it from 1 to 8 each way, which is the girth of the arc stretched out: then draw the other line 9 9, at the same distance as 9 8 on the plan; then draw the lines 1, 2, 3, 4, 5, 6, 7, 8, to the line 9 9, and take the distance from the chord line of the arch to the plan, as 1, 2, 3, 4, 5, 6, 7, 8: set from the line 8 8, as 1, 2, 3, 4, 5, 6, 7, 8, each way, from 1 to 8, and trace through those points, which will give the edge of the soffit; then take from the plan, *fig. h*, 2, 3, 4, 5, 6, 7, 8, 9, 8, 10, and set them on the soffit *r*, as 2, 3, 4, 5, 6, 7, 8, 9, 8, 10, and trace through those points, which will give the other edge and width of the soffit stretched out.

"*Fig.* I is a circular flewing and winding soffit in a circular wall, internal flewing. Continue the flewing of the jambs till the lines meet each other, the same as in *fig. g*; then extend the compasses from *a* to 9, and draw the arch line 9 9, and divide the two arches into a like number of parts, as here into 8: take one of those parts, and run it from 1 to 9 each way; then take one of the parts from the lesser arch, and run it from 3 to 1 and 3 to 2 each way, and draw the lines 1, 3, 3, 5, 5, 7, 7, 9, 9, 10; then take the ordinates from the base line of the great arch to the plan, as 1, 2, 3, 4, 5, 6, 7, 8, and set them from the arch line 1 9 on the ordinates 1, 3, 3, 5, 5, 7, 7, 9, as 1, 2, 3, 4, 5, 6, 7, 8, each way, and trace through those points, which will be the edge of the soffit. For the width of the soffit, take the ordinates from the plan, as 2, 3, 4, 5, 6, 7, 8, 9, 9, 10, and set them on the ordinates in the soffit S, as 2, 3, 4, 5, 6, 7, 8, 9, 9, 10, which gives the other edge of the soffit stretched out.

"*Plate* C 40. *Fig.* K is a circular flewing and winding soffit in a straight wall. Continue the flewing of the jambs till they meet at *a*; then with the radius *a*, 8, draw the arch line 8, 8; divide the greater arch of the soffit into eight parts; take off one of those parts, and run it each way on the arch line 8, 8, from 1 to 8; then take one of the parts from the lesser arch, and run it from 1 to 9, each way, on the arch line 9, 9; then draw the ordinates 2, 3, 4, 5, 6, 7, 8, 9, 8, 9; then draw a line, as 8, 2, at right angles with the face of the wall, and divide the thickness of the wall, *fig.* K, into four equal parts; draw them across the flewing line *a*, 8, to the right 8, 2; take the ordinates 1, 2, 3, 4, 5, 6, 7, 8, from the flewing line of the jambs *a*, 8, to the right line, and set them from the arch line 8, 8, as 1, 2, 3, 4, 5, 6, 7, 8; trace through those points, and it will give the edge of the soffit: then take the ordinates across the plan, as 2, 3, 4, 5, 6, 7, 8, 9, and transfer them on the soffit, as, 2, 3, 4, 5, 6, 7, 8, 9; trace through those points, and it will give the other edge of the soffit T, stretched out.

"*Note.* The edge of the soffit may be found another way, by drawing a semicircle equal to the semidiameter of the ellipsis, and draw the ordinates up to the circle: then the spaces between the two arches are equal to those on the plan; for 4, 1, between the arches, is equal to 2, 1, on the plan; and 3, 2, is equal to 3, 4, and 2, 3, is equal to 5, 6, on the plan, &c.

"*Fig.* L is a parallel flewing and circular soffit in a straight wall; *p*, the soffit stretched out. For this a centre must be made, to get the soffit; and a thin veneer bent round and marked by, which will give the edge of the soffit, &c.

"*Fig.* M shows the method for finding the pitch of a pediment to fronts. Suppose the chord line, 1, 3, to be the width of any pediment from out to out of the cornice; then set the compasses at O in the centre, and draw the semicircle 1, 2, 3; then set the compasses at 2, and extend to 1, and draw the arch line 1, 4, 3; then draw the chord lines 1, 4, 3, which is the pitch of the pediment. If it be a circular pediment, the arch line 1, 4, 3, is the top, or pitch, &c.

"*Fig.* N shows the method for finding the centre of any segment arch. Suppose the points *a*, *b*, *c*, to be put down promiscuously; set one foot of the compasses at *a*, and draw the arch line 3; then set at *b*, and draw the arch line 4; then set one foot of the compasses at *c*, and draw the arch 1; then set at *b*, and draw the arch 2; then draw lines through the bisection of those arches, or ox-eyes, till they meet at *d*, which will be the centre that will touch the three points; and so for any other."

In the "*Practical House Carpenter*," by the same author, we have the following:—

"*Plate* C 41, *fig.* 1, is a dome on a circular plan; *a b* show the section of the horizontal rib. *Fig.* 2 is a conical skylight, showing how to bracket the angles of the ceiling under the curb: the hip mould, *g*, at the angle, is traced from the rib, *b*, and that mould would do to cut all the ribs at the angles, as shown at the angle *a*. *Fig.* 3 is an ogee roof, whose plan is a pentagon, and shows the method for drawing any polygon figure to a given side: make a radius of the side, and draw the arches 2, 6; divide one of those arches into six parts; turn them to the centre line, as shown by the letters 5 *d*;

4 *e*, &c.; the centre, *c*, will draw a circle to receive the side five times, 6 is the centre to receive six times, *d* seven times, and so on to *i*, which is the centre to draw the circle to receive the side twelve times. *Fig.* 4 is a dome, whose plan is a hexagon, and shows how to divide a circle into any number of parts: divide one-fourth of the circle into the number of parts you would have the circle, as 1, 2, 3, 4, 5, 6: and always take four of them; to find the backing of the curve line hips, lay down the plan of the hip at the angle, as *a*, then take the distance 1, 2, from the plan of the hip, and set 1, 2, at bottom, tack in a nail, and shift the hip mould, and marking by it, as 1 2, 3 4, 5 6, 7 8, 9 10, will show the wood to come off.

" *Plate* C 42, *fig.* 1, is a dome on an elliptical plan; the centres for the mould for the horizontal ribs, *d d*, are *a a*, *b b*, *c c*, *d d*, the place of that rib on the plan is found by dropping dot lines from the sections *d d*; *c c* on the top is designed for a skylight. *Fig.* 2 is a bevel roof; the sides are parallel on one part of the plan, the other bevels: to frame this roof in ledgment, the principal rafters must be framed to a level base, that is, the ends of the beams all of one height from the face of the plate; when you come to lay them the other way to frame in the purlins, there must be winding sticks held to the bases of the rafters, which winding sticks must be all out of winding, and as the width of the building diminishes, the backs of the rafters will lie in winding, as they will be when in their places; and mind that they are backed according to the bevel of the plan, for turning them up to tumble in the purlins: by this method the business may be well completed. *Fig.* 3 shows the method for cutting the boards to cover a dome. Divide the dome into as many parts as you think it will take boards; and draw lines to cut the edges of each board, and where they meet the centre line, that is the centre for the edge of each board.

" *Plate* C 44. K shows the centring for groins. L is a half groin cutting under pitch for door or window; G is a Welsh groin cutting under pitch; M is the method for tracing the ribs and hips for a groin ceiling; N, a mould to bend over the body range; K, to get the lines to set the jack-ribs by."

In reference to *Plate* C 41, *fig.* 2, it may here be observed, that Mr. Pain has corrected this figure from that which appeared in his first edition from having seen Mr. Peter Nicholson's " *Carpenter's New Guide.*" It is, however, still defective, as he has not shown the rib, *b*, nor the angle, *a*, to which he has alluded in the text. On this figure, in the plate, are the following words:—" A dome with a skylight on the top; G G, moulds for the ribs of the dome; *a a*, the curb of the light."

Independently of the authors we have named, many others have written treatises on this branch of architecture; but their information being principally gleaned from those who preceded them, we have not thought it worth our while to make extracts from their works. It now, therefore, only remains for us to state, that to the inventions and discoveries of the writers quoted, and which may be reduced to the following, sections of prisms at right angles to one side or plane of the prism, coverings of prismatic and conic surfaces in the most simple cases, and the method of ascertaining the lengths and backings of hips, Mr. Peter Nicholson, the author of Nicholson's "*Architectural Dictionary*," and many other scientific and useful works, has, according to the statement which he has given in the "*Architectural Dictionary*," and which we take leave to transcribe, added those of the intersection of one plane with another, the latter resting on three lines perpendicular to the former; the geometrical construction of all cases in spherical trigonometry, by solid angles; sections of a prism, cone, or cuneoid, through any three given points; the section of a prism making a given angle with a given parallelogrammatic section of such prism, and passing through any given line on the said section; the section of a cone passing through any line on a given axal or vertical section, and making a given angle with that section; the section through any three given points on the surface of a body, of such property that all sections parallel to a certain plane will be similar figures, having the seats and heights of the points upon one of the similar planes, and another section of the body in a given position to that plane, cutting all the said similar sections; the sections of various other bodies, whose properties are defined; the formation of the edge of a thin pliable surface, which, when bent upon the surface of a prism, may coincide in its edge with a section passing through any three given points on the surface of the said prism; the formation of the edge of a surface, to fit a conic section, passing through any three given points on the surface of the cone, while such surface and that of the cone coincide; the formation of the edge of a thin pliable surface to fit the section of a body cut by any prismatic surface, while the pliable surface coincides with that of the section made by the prismatic surface; the properties of the body being such, that all sections parallel to a certain plane will be similar figures given a section of the body parallel to one of these sections, and another cutting all the said similar sections in a given position, and the intersection of the given planes on each other.

These subjects include the finding of the sections of cylinders and cones, spheres and spheroids, and the coverings of these bodies under the circumstances already stated. To these, Mr. Peter Nicholson has added the following inventions or discoveries, viz. the method of extending the surface of a cylinder or cylindroid, being the centre of an arched aperture in an oblique wall, terminated by the faces of the said wall; and the covering of the surface of a part of a semicone, being the centre of an aperture, with its axis oblique to the surface of the wall which terminates such covering; in ascending groins, he has likewise shown the centring for brickwork, and ribbing for plastering; the construction of polygonal and annular groins, both level and ascending in a spiral, whether for centring or ribbing; cylindro-cylindric arches, or what are commonly, but improperly, called Welsh arches; spherical niches, both for straight and circular walls, under any circumstances; the true methods of constructing pendentine or spandrel ceilings, either spherical or spheroidal; the bevels of purlins in all positions to the common rafters; the formation of boards for covering spherical domes, without laying down either plan or section of the dome, entirely within the boards themselves; the forming of the lower boards, without centres, in the covering of a dome, with the joints in horizontal planes; the formation of boards to cover a spheroidal dome, with the joints of the boards in vertical planes; the covering of an elliptic dome with one mould only; the covering of a spheroidal dome with boards having their joints in parallel vertical planes; the construction of a dome with horizontal ribs, without taking the trouble to square them by horizontal and vertical faces; the method of cutting purlins and jack-rafters to fit the hips, without laying the roof in ledgment; principles for the equilibrium of polygonal roofs without ties, so that the rafters may obtain a given ratio among themselves, provided the abutments be sufficient; a principle for preventing rafters without intermediate ties from having any lateral pressure: these two latter inventions have been several years before the public, in the architectural plates of Rees's Cyclopædia. To these might be added various other principles of less importance, which it is not necessary to recapitulate in this place In most of the subjects above alluded to he has given more than one method of operation, and in some instances he has multiplied his examples to five or six different modes of practice.

One or two of the inventions in the foregoing list, he acknowledges, are only his own by their new application, the principles being known prior to his time; but he has adapted them to subjects to which they were never before applied; and he conceives that it requires at least as much ingenuity, and is frequently attended with more utility, to be able to apply an old or well-known principle to a useful object, as to discover a principle destitute of practical application: he has, therefore, not scrupled to include them in the list of his discoveries. Nor has he, in the "*Architectural Dictionary*," while thus claiming credit for himself, denied it to others; as may be seen in his remarks on Pain's lining of a cylindric soffit in a circular wall, the principle of which was previously laid down by Price in his centrings of groins. The inventions which Mr. Nicholson has thus appropriated to himself are the following: the application of the principle of covering the surface of the frustum of a cone to a spheroidal dome, with the joints in vertical planes; the application of the principle of covering an oblong spheroidal dome by one mould only; and the application of the principle shown by Price, in his centring of groins to a cylindric soffit for an aperture in a straight wall, with its axis oblique to the surface of such wall; which latter was likewise attempted by Pain, but without success.

Having thus furnished the reader with the foregoing information from the works of the several authors who have preceded those of the present day, we shall refer him to the article *Constructive Carpentry*, for a treatise on the art as it is now practised.

Carrara marble. The name of a species of white marble, which is called *marmor lunense*, and *ligustrum*, by the ancients; it is distinguished from the *Parian*, now called statuary marble, by being harder and less bright.

Carrel. *In the Middle Ages.* A closet, or apartment, for privacy and retirement.

Carriage. The frame or timber work which supports the steps of a wooden stair. See *Staircase* and *Handrailing*.

Cartel. See *Cartouch*.

Carton, or cartoon. A design made on strong paper, to be afterwards calked through, and transferred on the fresh plaster of a wall to be afterwards painted in fresco; it also signifies a coloured design, for working in mosaic, tapestry, &c.

Cartouch. An ornament, representing a scroll of paper, being usually in form of a table or flat member, with wavings, whereon is some inscription or device, ornament of armory, cipher, or the like. It is nearly akin to a modillon, from which it only differs in this, that the latter is used both externally and internally, as under the cornice in the eaves of a house, and the former only internally, as in wainscotting. Some workmen call the cartouches *dentils*.

Carved work. Mouldings, &c. fashioned by the carver.

Carver. A cutter of figures or other devices in wood.

Carving. The art of engraving or cutting figures in wood; and is, according to Pliny, prior both to statuary and painting. In a more general sense, it is the act of cutting or fashioning a hard body by means of some sharp instrument, especially a chisel; in which sense it includes statuary and engraving, as well as cutting in wood.

Caryatic order. An order of architecture wherein the entablature is supported by female figures clothed in long garments, instead of columns; the figures so supporting the columns being called Caryatides, Cariates, or Carians. In *plate* C 2, we have given representations of three kinds of caryatides: that on the left-hand side of the plate is a copy of one of the figures that surround the choir in the cathedral of Milan, the work of Andrea Biffi, a celebrated Milanese sculptor; and the other two are taken from paintings of Daniel da Volterra, in the church of the Trinita del Monte, at Rome. In *plate* C 3, an elevation of the caryatic portico of the Erechtheion; and in *plates* C 3*, 4, and 5, the caryatides on a larger scale.

The origin of this order Vitruvius tells us is as follows:—

"The inhabitants of Caria, a city of Peloponnesus, having joined the Persians in a war against the rest of the Greeks, and that war being terminated by the defeat of the Persians, the Greeks declared war against the Caryatides, took their city, demolished it, put all the males to the sword, and carried the females into captivity; and, to treat them with the greater ignominy, forbade the ladies to divest themselves of their robes, or any of their ornaments, that they so might not only be once led in triumph, but, in a manner, suffer the shame of it all their lives after, by appearing constantly in the same dress as on the day of triumph; and further, as an everlasting testimony of the punishment inflicted on the Caryates, and to inform what had been the nature of their chastisement, the architects of that time, instead of columns, employed the representations of these women to support the entablatures in their public buildings."

Vitruvius proceeds to inform us, that "the Lacedemonians after the battle of Platea, erected with the spoils and plunder the Persian portico, as a trophy to transmit to posterity the valour and honour of the citizens; introducing therein the statues of the captives, adorned with habits in the barbarian manner, supporting the roof. Thus, with merited infamy, they punished pride, terrified their enemies with the idea of their power, and the citizens beholding this monument of their courage, were inspired with a love of glory, and became more animated in the defence of their liberty."

The Greeks and Romans had also two other denominations for these figures, derived from their action of carrying or supporting, *Atlantes* and *Telamones;* but Caryatides has now become a modern generic term for these statue columns.

Notwithstanding the ingenious manner by which Vitruvius has attempted to explain the origin of this order, it is very evident, from the concurrent testimonies of creditable authors, that the Greeks are not entitled to the credit of the invention, and that it can be traced among the Egyptians at a much earlier period.

Le Clerc says, it is not customary to represent, as formerly, Caryatides with attributes of slavery and servitude; such characters are too injurious to the fair sex: on the contrary, they are, at present, considered as the richest and most valuable ornaments of buildings; being represented under the figures of Prudence, Wisdom, Justice, Temperance, &c.

De Chambray blames this practice, and considers it an effect of inadvertency in the architects who first introduced it; observing, that if they had sufficiently reflected on the text of Vitruvius, with regard to the origin of Caryatides, they would have perceived the impropriety of employing the representations of saints and angels, loaded, like slaves, with cornices and other heavy burdens; and likewise that of employing the Caryatic order promiscuously in all sorts of buildings, particularly in sacred structures, which are the houses of God, and asylums of mercy, where vengeance and slavery ought never to appear.

On the other hand, Blondel observes, that, though his remark be just, if the origin of these ornaments be rigorously attended to, yet to serve in any shape in the house of God, and in particular at the altar, hath always appeared in the minds of the prophets, and the best of the saints, so great and glorious, that not only men, but angels, ought to esteem it a happiness; and, consequently, that it can be no indication of disrespect to employ their representations in offices which they themselves would execute with pleasure.

The ancients, says Blondel, made frequent use of Caryatic and Persian figures, and delighted in diversifying them in a thousand manners. The modern artists have followed their example, and there is a great variety of compositions of this kind to be met with in different parts of Europe. If they are employed to support the covering of a throne, they may be represented under the figures and symbols of heroic virtues; if to adorn a sacred building, they must have an affinity to religion; and when they are placed in banqueting rooms, they must be of kinds proper to inspire mirth and jollity.

In composing them, particular care must be taken to avoid inde-cent attitudes, distorted features, and all kinds of monstrous and horrid productions, of which there are such frequent instances in the works of the Goths. On the contrary, the attitudes must be simple and graceful, the countenances always pleasing, though varied, and strongly marked with the expression peculiar to the occasion and object represented. There must be but little flutter in the drapery, which ought to fit pretty close to the body, and its folds should be contrived to express directly both the action and the shape. Le Clerc observes, they should always have their legs close together, and their arms close to the body or head, that they may have, as much as possible, the form of columns, whose office they are to perform; and it may be added that, for the same reason, their attitude should be as near a perpendicular as it can conveniently be, without giving a stiff and constrained air to the figure.

The same author observes, that Caryatides ought always to be of a moderate size, lest, being too large, they should appear hideous; and, indeed, as these figures are generally represented in endearing offices, and under the forms of amiable and benevolent beings, the caution seems to be extremely proper; and it will therefore be judicious not to make them larger than the human figure. But the male figures may be made of any size, and the larger the better, as they will then be fitter to strike with awe and astonishment.

Male figures may be introduced with great propriety in arsenals, or galleries of armour, in guard rooms, and other military places, where they may be represented under the figures either of captives or of martial virtues, such as Strength, Valour, &c. Their entablatures must be doric, and bear the same proportion to them as to columns of the same height. The proper entablatures for Caryatides will be either ionic or corinthian, accordingly as the character of the figures is more or less delicate. Persian and Caryatic figures ought never to be employed to support the same entablature with columns; for figures of men or women as high as columns are considerably more bulky, and, when they are of an uncommon size, carry with them an idea of greatness that entirely destroys the effect of the columns, making them appear very trifling; neither should they, for the same reasons, be placed upon columns, as in the court of the old Louvre at Paris.

It is somewhat customary to employ Termini instead of Caryatides or Persians, to support the entablatures of monuments, chimney pieces, and such like compositions. These figures owe their origin to stones, used by the ancients to mark the limits of each particular person's possessions. Numa Pompilius, to render these inviolable, and to prevent usurpations, erected the Terminus into a deity, instituted festivals and sacrifices to his honour, and built a temple on the Trapejan mount, which he dedicated to him, and in which he was represented under the figure of a stone.

The upper part of the Termini represent the head and breast of the human body, and the lower part an inverted frustrum of a square pyramid, with the feet sometimes projecting out below, as if the body had been partly cased.

As Termini are susceptible of a variety of decorations, they may be employed as embellishments for gardens and fields: where they may represent Jupiter, the protector of boundaries, or some of the rural deities, as Pan, Flora, Pomona, Vertumnus, Ceres, Priapus, Faunus, Sylvanus, Nymphs, and Satyrs.

Cascade. A fall of water from a higher to a lower place. Cascades are either natural, as that of Tivoli, &c. or artificial, as those of Versailles, &c. and either falling from a great height, as those of the Sceaux, in form of a buffet, as at Trianon; or down steps, in form of a perron, as at St. Clare; or from basin to basin, &c.

Case. An outside covering, box, or sheath, in which an object may be enclosed; it also implies the carcass of a house.

Case-bags. The joists that are framed between a pair of girders in naked flooring. When the flooring joists are framed with one of their ends let into a girder, and the opposite ends let in the wall, they are called *tail bags.* The dimensions of the case-bags of floors and roofs ought not to exceed 10 feet.

Case of a door. The wooden frame in which a door is hung. See *Door and Door-frame.*

Case of a stair. The wall which surrounds a staircase.

Cased. A term which signifies that the outside of a building is faced or covered with materials of a better quality; for example, a brick wall is sometimes faced with stone, or with a superior kind of brick to that used in the back part of the wall.

Cased sash frames. Sash frames having their interior vertical sides hollow, to conceal the weights bv which the sashes are hung.

Casemate. A hollow moulding, which some architects make one-sixth and others one-fourth of a circle.

Casement. A glass frame, or sash, which is made to open, by turning on hinges affixed to one of its vertical edges.

Casing of timber work. The plastering of a wooden house all over on the outside with mortar, and making it resemble stone work, by striking it, while wet, by the corner of a trowel or the like instrument, guided by a rule, which gives the exterior of the house the appearance of a stone building. This is best performed on heart laths, because the mortar is apt to decay the sap laths in a short time. It is commonly laid on in two thicknesses, the second before the first is dry.

Cassine. A country house. A house surrounded with a ditch, like those of the noblesse in Flanders, or those of the feudal lords or barons, favourable for the reception of a small body of men, who are placed by it out of the reach of an attack or a surprise, and can defend themselves in it till detachments come to their relief.

Cast. A little brazen funnel used by plumbers at one end of a mould, for casting pipes without soldering, by means of which the metal melted is poured into the mould.

Cast. A term, in sculpture, for the impression of any figure taken in bronze, plaster, wax, or other fusible metal.

The process of casting is as follows:—Plaster of Paris is mixed with water in a basin or pan, and stirred with a spatula until its consistence is like that of batter for pancakes; it is then poured on the figure of which the impression is to be made, and which figure has been previously greased or oiled in the slightest possible manner, to prevent the adhesion of the plaster; after a few minutes the plaster acquires the hardness of soft stone, and may be removed from the object on which it has been placed, when it will be found to contain an exact impression of every part, even the minutest pores of the skin. This impression, which is the reverse or hollow of the original subject, like a seal in comparison with its impression, is called the mould. The mould being removed from the figure, and slightly greased, may have plaster mixed with water as before, poured into it; and this, being allowed to remain till it has become hard, and then removed from the mould, is an exact image of the original figure. If the figure be flat, having no deep hollows or high projections, it may be moulded in one piece; if its surface be varied with great hollows and projections, it must be moulded in many pieces fitted together, and held in one or more outside or containing pieces. This useful art supplies the painter and sculptor with exact representations from nature, of limbs, bodies, heads of men, and inferior animals, anatomical subjects, draperies, and plants; it multiplies models of all kinds, and is now practised in such perfection, that casts of the antique statues are made so precisely like the originals that no difference whatever is discernible, excepting in colour and materials. See *Bronze.*

Castella. One of the three kinds of fortifications that were built along the line of Severus's wall; the other two being denominated *stations* and *towers.* These castles were neither so large nor so strong as the stations, but much more numerous, being no fewer than eighty-one. In shape and dimension they were exact squares of 66 feet every way. They were fortified on every side with thick and lofty walls, but without any ditch, except on the north side, on which the wall itself, raised much above its usual height, with the ditch adjoining it, formed the fortification. The castles were situated in the intervals between the stations, generally at the distance of about seven furlongs from one another. and guards were constantly kept in them by a competent number of men detached from the nearest stations. (*Hors. Brit. Rom.* p. 108.)

Castella. *In Roman Antiquity.* A reservoir in which the waters of an aqueduct were collected; from whence the water was conveyed through leaden pipes to the several parts of a city.

Castellated houses. See *Houses.*

Casting. The act of taking the impression of any surface, by pouring a liquid, which possesses the property of hardening upon its surface. See *Cast, Bronze, Plumbing, &c.*

Casting of brick or stone walls. See *Rough Cast.*

Casting. *In Carpentry and Joinery.* A term analogous to warping. See *Warping.*

Castle. A place fortified either by nature or art, in a city or country, to keep the people in subjection, or to resist an enemy. In the more extensive interpretation of the word, it includes the various methods of encampment; but, in its stricter meaning, it is usually applied to buildings walled with stone, and intended for residence as well as defence.

In tracing the rise and progress of this branch of architecture, we shall witness the gradual intermixture and decay of the Roman art, and the successive improvements made in the Northern, Saxon, and Norman styles; we shall also observe the successive gradual changes which were introduced in the ancient modes of accommodation and defence, and the almost imperceptible transitions, made by the ancient chieftains of this land, from a residence in stately, formidable, inconvenient strong holds, to that of embattled mansions, (embattled without use, and almost without meaning,) and eventually to convenient and elegant palaces, abounding with the luxuries of life.

Some of the earliest castles are still existing; we can, therefore, with some degree of certainty, speak of the nature of their construction. Two of them especially deserve our attention—that of Connisborough in Yorkshire, and Castleton in Derbyshire, the antiquity of which, upon examination, will appear of much greater antiquity than is generally conceived. Of Connisborough, Camden states, that it is an old castle, called in British *caer conan*, situated upon a rock, whither, after the battle of Maisbelly, when Aurelius Ambrosius had routed the Saxons, and put them to a disorderly flight, Hengist, their general, retired to secure himself; a few days after which, he took the field again against the Britons, which proved fatal to himself and to his army.

This castle has a most extraordinary appearance, and is very much unlike a Norman fortress. The great court, it is true, has some resemblance to the courts of other castles, but even this, when carefully examined, will be found to be very unlike those ballia that were in use after the

An area appears walled in, which was entered by a great gateway between two round towers, after passing a drawbridge and deep ditch; but this area has neither the regularity nor the extent of those of the Norman castles, nor any appearance of those additional interior buildings, beside the keep, which were common with that people; in short, the area of this strong hold might just as well be compared to the Roman castle at Richborough, as to any Norman fortress; and might be supposed, with the same degree of probability, to have been formed by a Roman general as by William de Warren, to whom it has been attributed. This extraordinary castle stands in one corner of the area, and commands a most glorious view of the windings of the river Dun, or Dune, and of the adjacent country.

Plate C 65.—The first thing that strikes the eye is a very remarkable sloping part of the foundation walls, rising to a great height, like a mount, and having in many parts, in consequence of its being covered with earth and moss, the appearance of a small hill, *e, f, g, h, fig.* 1, exactly of the same dimensions as the castle itself. The bottom of this sloping part appears almost circular; but higher up are seen, more fully, six vast projecting buttresses, ascending in a still more steep direction to prop and support the building. Modern engineers would, perhaps, call the whole a regular *glacis*, or rather a *talus*.

Immediately above this sloping part the tower rises perpendicularly, to a great height. Its inside forms a complete circle, but on the outside appear six additional square turrets; which are, however, merely the continuation upwards of the buttresses just mentioned.

The walls of this tower are very nearly half as thick as its diameter within, which is about 21 feet; and some of the turrets as they ascend towards the top are in a very few places hollowed out, and converted into closets, which have narrow loops.

Having surveyed this strange appearance of the outside, the next thing that draws attention is the ascent to the grand entrance, which is, and most probably always was, by an exceedingly steep flight of deep steps, *a*, *b*, not much more than 3 feet in width, on the south side. These steps are so shallow, in the space for setting the feet, and having no rail to hold by, and an absolute precipice on either side, that even the going up is frightful, and the coming down not to be accomplished without help, except by workmen accustomed to scaffolds, and the impending heights of lofty buildings.

At the top of this ascent is a great doorway, *a*, very low, however, in comparison to those in Norman towers, and of very singular construction; for although there is a stone arch turned over it, probably in imitation of those which had been seen in Roman buildings, yet the nature of such an arch seems hardly to have been understood, for directly across the diameter, and underneath it, is placed a great *transom stone*, like a beam; and the space between it and the arch is filled up with stone work, as if to assist the arch in supporting the wall above.

Upon the whole it makes a most grotesque compound, of the door of an ancient *dun*, or even of an old Egyptian temple and Roman arch, seeming to proclaim aloud the age in which it was built, to have been a period when a little improvement in architecture had been made, in consequence of seeing a few Roman works, but when the rude architects had not seen enough, nor been sufficiently informed to comprehend them.

On entering the door, we find an area, in the thickness of the wall, like a little vestibule, *a*, *fig*. 4. On one side of this is a passage to the staircase, which ascends not in a spiral form, as those of latter ages, but goes straight through the thickness of the wall, like the rude staircase of an ancient northern dun; it is, however, well and neatly constructed, and has a noble appearance. This staircase has no communication with the room on the first floor, except through the vestibule; and, therefore, might be ascended without entering into that room.

The room ought not, however, to be passed by unnoticed: it is completely circular, and has no window or even a loophole to it. But in the centre of the floor is a round aperture like the mouth of a well, *b*, *fig*. 2, which opens into a most dismal, dark, deep dungeon, *b w t*, excavated out of the midst of the artificial mount, and enclosed within the sloping part of the foundation walls, and rudely vaulted over; at the bottom appears to have been a draw well, but there was no admission for light or air, except through the aperture *b*; nor could the room, in the floor of which this aperture is, have the benefit of either, when the door was shut, except by means of a similar aperture, which there must have been, at *c*, in the floor above. We cannot therefore err in calling the lower of these frightful apartments the dungeon; and that next above the store room, and the aperture at *c*, must have answered the triple purpose of drawing up water, of drawing up stores, and of admitting air and light: to let in the latter the more effectually, there is good reason to suppose, that a similar aperture was left in every floor, to the very top of the castle; and the rather, because, without such, even the state apartments would be most wretchedly dark, each of them having no more than one window.

In other respects we shall find they were highly finished, and magnificent for such a barbarous age.

The ascent of the grand staircase, from the vestibule, through the wall, from *a* to *d*, *fig.* 4, is stately. It has no necessary communication either with the store room or dungeon, and enters at *y* into a fine circular room, the floor of which appears to have been supported, not by timbers *let into* the wall, but *laid upon* great projecting trusses of stone, which still remain all round the building. This room appears to have been finished and adorned with as much elegance as the times would admit. The stone work is exceedingly compact, smooth, and good; the entrance from the staircase at *d* F V is by a handsome arch; and directly opposite to it is another at *f*, equally as well constructed, leading to the second flight of stairs, which go up to the state apartment, passing through the wall from *f* to *e*.

Fig. 2 shows the concave interior half of the tower, looking towards the south.

Fig. 3 shows the concave interior half, looking towards the north.

Fig. 4 is the plan of the first floor, on which you enter from the grand portal; and

Fig. 5 is the plan of the first grand apartment, of which we are now speaking.

In *figs.* 2 and 3, *d v* is the section of the cavity, through which the first flight of stairs ascends, within the thickness of the walls; and *e x* is the section of the cavity through which the second flight ascends; *m n* is the section of the floor of the first grand apartment; and *o p* the section of that of the state apartment.

As to the rest, the letters of reference, both in the section and plans, all correspond.

The first grand apartment was probably the guard room, or chief place of rendezvous, of the principal part of the garrison, and in this there is one object that most obviously strikes the eye at first glance, and raises astonishment in the mind; a vast fire hearth at Z, *fig.* 3, on the north side, constructed with an elegance which resembles that of these latter ages, but having a chimney carried up through the wall like those in other ancient castles, and opening through a loop on the outside. The front of this fireplace, however, is supported just like the door of entrance, by a wide arch, not trusted to as sufficient for the purpose, but having two great transverse stones running across under it. To this rude imitation of the Roman arch is joined as rude an imitation of ionic or corinthian pillars; three of which, in clusters on each side, support the transverse stones, and at some little distance produce the elegant effects mentioned, of the resemblance of a modern ornamented chimneypiece.

The whole device seems most

strongly to indicate a period of time between the departure of the Romans and their arts from this country, and the introduction of savage foreigners, and their final establishment here; a period between the loss of Roman architecture, and the introduction of the Gothic; a period when barbarians, just arrived, mixing with the rudest part of the natives, were prompted to imitate imperfectly, and as far as their conceptions would allow, the few specimens they had seen of Roman magnificence.

The next thing that attracts the eye, is a narrow doorway, *h*, *fig.* 2, where the arch was either forgotten, or thought quite useless; and where a transverse stone alone covers the top; this led to a closet, that served for a privy, excavated as it were out of one of the great buttresses, and having a narrow winding drain to a side loop.

In this room there are no windows; but at *g*, *fig.* 2, there appears a great arch, which leads to a sort of recess, or small lobby, over the grand portal, wherein is the window that appears at *i*, *fig.* 1, commanding entirely the steps of ascent on the outside, but small indeed for the conveyance of light and air to this apartment. We must conclude, therefore, that it was moreover lighted, as already hinted, by a circular perforation in the midst of the floor above. The window just described, like the doorway underneath, has a handsome arch at top; but this arch, similar to the one above, is not trusted to, but has the assistance of a great transverse stone.

On one side of the fire hearth, and about half way between it and the door of entrance, is a little square niche in the wall, at *g*, *fig.* 2, too small for any serviceable use as a locker, or cupboard, and the original design of which may, perhaps, best be investigated from what we shall find in the state apartment over head.

To that apartment, after passing quite across this guard chamber, the approach is by a second flight of steps, constructed in the same manner, and as noble as the former; no winding staircase is seen, but a regular continued gradual ascent, going straight on through a cavity in the wall, from the arched door *f* up to another arched door *e*.

This chamber, from its decorations, appears to have been the place of royal residence; and it had a great window to the southwest at *r*, *fig.* 2, which is the only considerable one that appears in the whole building.

At S is an arched doorway, leading to a little room over the grand portal, which seems to have served for a bedchamber, and where, that no person resting therein might be injured by any missive weapon, no light or air was admitted, except by a narrow loop, although the only great window of the lower apartment was directly under it.

As the upper state room was not designed to contain a great number of persons like that beneath, the fire hearth is smaller, but rather of still more elegant construction. In this we also find the imitation of Roman capitals, and a transom stone, instead of an arch; the former appearing to have been constantly thought the greater security, where there was any considerable width and a weight above to be supported; indeed, the arch appears to have been deemed only an additional help, for it is very remarkable that, in this building, all the arches which are without transom stones are very narrow.

But the most remarkable appearance in this room, and indeed in the whole structure, is a small niche, at *l*, *fig.* 3, richly ornamented, the design of which can hardly be mistaken. From its dimensions and form it seems totally unfit for any other purpose than that of containing some small idol, and strongly indicates that this castle was built, and in use, in pagan times.

And now, whoever considers, in this building, the rude but diligent imitation of Roman architecture, the staircase running straight through the walls, without any turnings or windings, exactly like those in a northern dun, the whole inside differing so little from that of a dun, and only having smoother and better finished walls and arches, and the floors contrived to hold more people, and better to exclude the weather, but still leaving a circular area from top to bottom, open in the middle, and considers the unlikeness of the whole to any Norman structure, and adds to these considerations the appearance of the niches, will, I think, have little scruple to allow, that nothing can more strongly proclaim an age of pagan barbarity and ignorance, struggling amidst the disadvantages it laboured under, and striving to emerge from its wretched state, to a degree of civilization and refinement.

We cannot, therefore, but conclude this tower to have been built by Hengist, or some Saxon king, before the conversion of that people to Christianity, and to be one of the most ancient, as well as the most perfect, remains of antiquity in this kingdom.

Neither machicolations, nor the portcullis, nor the mode of securing loopholes, seems to have been invented at the time this tower was built.

We shall therefore call it a Saxon castle, of the first ages of the heptarçhy, begging leave to oppose an idea, too commonly received, that all these castles were Norman structures, and that the Saxons had no fortifications but of earth, which is undoubtedly no more true than that the Romans had only such; an assertion that, notwithstanding their numerous camps fortified in that manner, can never be supported whilst the ruins of Richborough remain.

What greatly confirms also the idea of this castle being built at the time of which we speak, is, its very near resemblance to a Scotch dun; it appearing, indeed, to be only the first improvement of such a kind of building, by architects a little more civilized.

We are well informed, that the Saxons had made a league with the Picts and Scots about that era; and that the greatest part of their force consisted of great bodies of those people, who joined them when they issued out of Kent towards the north, assisted them to waste all Britain to the western sea, and were their confederates when they seized this very part of the country. If, therefore, we may be allowed such an odd conception, we cannot but view this tower as proclaiming an alliance of Pictish, Scottish, Saxon, and Roman architecture.

The preceding information is extracted from Mr. King's observations on ancient castles, in the "*Archæologia*;" but Mr. Britton, in "*The Architectural Antiquities*," has supposed this castle to be of

Anglo-Norman construction; we ourselves, however, are more disposed to coincide with Mr. King.

Plate C 66, *fig*. 1, is the door of an old Saxon tower of a church at Lincoln.

Fig. 2 is a slight sketch of a doorway of the old tower of the church of the knights templars, at Temple Brue, which was undoubtedly Saxon, although the inside was afterwards, by the knights templars, adorned and lined with pointed gothic arches.

And *Fig*. 3 is a remarkable old Saxon arch, in an ancient building, opposite to the palace of John of Gaunt, at Lincoln.

The next castle which strikes us with high ideas of its great antiquity, is Castleton, in Derbyshire, perched proudly, like a falcon's nest, on the summit of an almost inaccessible rock, high impending over the mouth of one of the most horrid and august caverns that nature ever formed. The eminence whereon it stands is nearly insulated; the top of the adjacent hill over the cavern being much lower, and joined even there only by a steep precipice falling from the summit of the one down to the other.

On the west and east sides the rock is quite perpendicular; and to the north and south so steep that it cannot be ascended without the utmost difficulty. The whole commands a fine view of the country round, and of the mountain called Mam Tor, with the double fosse of the old encampment, so little known, placed on the highest brow of that shivering mountain.

There is not even any tradition preserved of the first building of Castleton. And some herring-bone work in the walls shows that it must have been of vast antiquity. Camden, speaking of the village of Burgh, in Derbyshire, says, "Near this Burgh there stands an old castle, upon the top of a hill, formerly belonging to the Peverells called the castle in the peake, and in Latin *de alto pecco*; which king Edward III. gave with this manor and honour to John duke of Lancaster, his son, after he had restored the earldom of Richmond to the king." But he does by no means assert that it was built by the Peverells, or any Normans; and, indeed, all that appears from the best account that can be obtained, amounts merely to this; that in this castle William de Peverell, natural son of William the Conqueror, had his residence, and kept court; and that he had also another habitation connected with this at Brough, or Burgh, near Castleton; from whence was an ancient road to Buxton, called, long before his time, Batham gate, or the gate leading to the bath; all which plainly imports that here was a very considerable fortress, the dwelling of some ancient chief and his train, for whose use such road was made long before the conquest; and that even William de Peverell, so far from having built it, found the smallness of this tower inconvenient.

After the first towers built upon this small, confined, and rude plan, the next improvement in the military art of defence, and in national fortifications, was by that great and extraordinary man, for the times in which he lived, king Alfred. Educated in the school of adversity, and taught, by suffering, to seek surer and more convenient means of protection for himself and his people than those with which they were as yet acquainted, he contended with ancient prejudices, brought from abroad all the information he could gain, and improved that knowledge by the assistance of his own great natural genius and that of the most enlightened of his contemporaries. He applied every known improvement of architecture to military purposes, which before his time had been confined almost wholly to religious structures, and erected noble fortresses in different parts of the kingdom. To him, or at least to his skill and abilities, we owe those once glorious piles, Colchester castle, built by his son king Edward, and Norwich castle, built by king Canute, in imitation of the style of building introduced just before the conquest.

Norwich castle is a most noble specimen of Saxon architecture. There is, however, a tradition of its having been built by Roger Bigot, about the time of William Rufus, and of its having been finally completed by Thomas de Brotherton, even so late as in the time of Edward II., but we suspect this to be a mistake; for, though it may be true with regard to the outworks, and the many great buildings enclosed within the limits and outward walls of this castle, yet, with respect to the keep, or master tower, which is the only considerable part now remaining, it may be said, that the style of its architecture is so different from the towers erected in the reigns of William Rufus, and Henry I. and II., and the ornaments so different from those which were in use in the reign of Edward II., that we cannot but conclude that this building is of much greater antiquity, and completely Saxon; though it is possible that the staircase might be repaired, or even rebuilt, by Thomas de Brotherton, whose arms are to be seen on a part of the wall. Whether we be or be not right with regard to the era of this building, certain it is that all its ornaments are of the true Saxon style; and whatever reparations it may have received at different times, they have been made carefully to conform thereto, so that it may be considered as one of the most complete remains of Saxon architecture in the kingdom. In this place we cannot but observe, that the resemblance which the devices and mode of fortification in this castle, and that at Colchester, have to those built even in the more improved Norman times, seems to indicate that the general plan was taken from structures of a still earlier date; especially as Josephus's description of the tower of Antonia at Jerusalem, may lead us to suspect this mode of building to have been very ancient indeed, and to have been known and introduced even before the age in which he lived.

In taking a survey of this castle at Norwich, we shall find almost precisely the same cautions used as in that at Rochester, which will be hereafter detailed. Amongst these, the first and most striking circumstance that offers itself to our attention, is the ancient mode of entrance; it was by a large stone staircase, running along the eastern front of the building, and ascending to a very beautiful little tower, at the north-east corner: see *plate* C 67, *fig.* 1. The wall of this staircase is shown in the sketch; and as a great part of it still remains entire, with two little windows that were originally in it, we have represented the whole. Upon these steps, which, though they have been often repaired, appear pretty nearly in their original situation, are two great stone arched doorways, one over *a*, and the other over *e*, which formerly had strong and massive gates to them. Beyond these, higher up, and just beneath the uppermost window, is a platform, where the steps are for a space discontinued, and where there is every appearance of there having been a drawbridge. Beyond this is a larger arch, with stone pillars on each side: from this platform the steps were again commenced, and were continued quite up to the first grand portal, the outside of which, though now bricked up, is shown at *b*.

Beside this, there does not appear to have been originally any entrance to the inside of the castle, except by a small narrow arched passage, some feet from the ground, situate beneath the drawbridge; which passage now leads from the inside of the castle to the debtors' cell, and is that through which the present entrance is into the lower part of the castle. The debtor's grate is represented at *o*, and this passage, which was unquestionably the sally-port, is just behind it. As there is a resemblance between the first grand portal here and that at Rochester, so, in the next place, we find here also a vestibule in the little towers, between it and the second portal. This vestibule was much exposed, and, in appearance, carelessly defended; for each of the three great arches seen at *c*, together with a fourth, at the north end of the room, though now bricked up, were formerly left entirely open. They are so large, and take up so great a portion of the side walls, that this vestibule must have had almost the appearance of an open portico, and must have been a very beautiful ornament to the castle; whilst its great height, and its being merely the passage between the first and second portal, rendered it not in the slightest degree detrimental in case of a close siege. This vestibule has now not only the arches bricked up, but is divided into two rooms, the one over the other, it being in the upper room principally that the remains of the two portals are to be discovered. In this upper room is to be seen, directly opposite to the three arches represented at *c*, one vast arch in the wall of the castle, reaching across the whole side of the vestibule, and under that a second great arch, but of less dimensions, which was the second grand portal, and under this latter, in the lower room, the remains of the side pillars. In the upper chamber, near the floor, at the south-east end, may also be discerned the top of the first great portal, the outside of which is visible at *b*. From this vestibule there is still preserved a passage into the castle, and on one side of it is a small arch, now walled up, communicating with a winding staircase at that corner, which went to the top of the castle, as is shown at *a* in the plan, *fig.* 3.

Beneath the vestibule was originally an open arch and a vaulted room, or rather recess, left quite exposed to the area before the castle; its roof or ceiling being richly decorated with intersecting arches, which must have had a fine effect, and greatly increased the beautiful appearance of the front: notwithstanding, however, that it seemed so light and airy, it was by no means a weak part of the building; for the side walls of this recess are of extraordinary strength, and the wall at the back of it, adjoining to the castle, is 11 feet thick. Indeed, as this was the strongest part of the castle, the front arch is now filled up, and the recess is converted into the felons' cell, whose grate is seen over *p*, *fig.* 1, the entrance to it being now in the side wall from the debtors' cell. The vestibule, portal, and top of the stairs, being here at so great a height, there were not any windows whatever in the eastern front of the castle, except in the staircase and vestibule; for on the level with the grand apartments there were only loopholes, and those in the places where they are represented in *fig.* 1. The arches, therefore, as well as the pilasters, in this front, were merely ornamental, and even the two at *d*, which have so much the appearance of windows, are only a fantastic variation of ornament, probably placed there even by way of deception; but on all the other sides of the castle the windows were very magnificent, placed at a great height, and on the same floor where the principal and state apartments were situate. Four of them may be seen within the four great arches of the west front, *fig.* 2. There is, however, on this side, at *f*, a brick arch and modern window, which should be distinguished from the rest, as it has been forced out since the completion of the castle, as is evident from the breaks in the ornaments on the adjoining parts of the wall, where originally there was merely a loophole and arch leading to it. The door also at *g*, which is now the entrance to one of the staircases of the castle, marked *b* on the plan, *fig.* 3, has, in like manner, been forced out of late years, through a cavity or loophole.

In this western front, the space between the letters *h*, *i*, *k*, *l*, has been faced with new work, but the other parts appear to remain as they originally were. The new work has also been finished in a manner suitable thereto, and the windows have been preserved in the very places where the perforations of the old ones were found, and ornamented in a manner similar to those on the other sides of the castle, and to those in this front.

The two arches which we have before mentioned in this castle, as being intended to deceive by an appearance of weakness, which they did not possess, are shown at *m* and *n*; and, in order to make the deception still stronger, there were in each of them four loopholes at the top; but when we examine the inside of the building we find the wall as thick there as in any other part, and moreover flanked by two great buttresses, or rather oblique walls, each supported by a great arch, and reaching from the middle wall to the back of these arches, as represented by *c d e f*, *fig.* 3.

The inside of this castle, having been long used as a common county gaol, is so built up with a variety of rooms, cells, and offices, and all the great arches leading to the loopholes are so carefully bricked up, that many curious particulars, and marks of the old mode of fortification, can no longer be seen; enough however remains to merit attention.

The inside of this castle, instead of containing an open yard as it now does, was filled up with the floors of most magnificent and spacious apartments; and, though the timbers are now removed, and small sheds built against the walls, yet the traces of the original disposition of the whole may easily be discovered by any person accustomed to examine these kinds of buildings; there are also visible marks of the strong partition wall, running across from west to east. This wall has been thrown down from *d e* to *g h*, *fig.* 3; but a gaoler who was living at the time Mr. King examined this castle, remembered the foundation of that part being discovered under the pavement of the present yard; and also, that on digging by the side of it, they found great arches of communication made through it underground, and the obvious remains of vaults or dungeons. It further appears, that the apartments on the ground floor were vaulted over with stone; for a great part of the old vault, at *g l m n*, the great stone arches of the buttresses, *c d e f*, and a stone vaulting over a part where the present chapel is, between *c d* and *a p*, still remain.

At *d e*, where now appears the remaining partition of the projection wall, may be seen a part rounded off, and cased with brick, having the appearance of a round tower: in the middle of this, a deep circular cavity of stone work, like the pipe of a well, which has, says Mr. King, been filled up in the memory of persons now living, and which therefore was, in all probability, the original well in the wall of the castle, as at Rochester and Canterbury. What makes this still more probable is, that there was a passage to it from one of the galleries through the wall, the entrance to which, though now bricked up, is still visible.

As to the chimneys, or any of the other passages or cavities in the walls, they are all so carefully stopped up, and have so many buildings erected against them, that little or nothing is to be discerned as to their situation or structure. The staircase also at the south-west corner has its ancient entrance at the bottom at present stopped up, so as to have no communication with the inside of the building, except to those apartments which now comprise the hospital of the castle; and the lower entrance to it is now only through the forced doorway at *g*, *fig.* 2. The other staircase at the north-east corner is walled up entirely.

The next succeeding step in the alteration of military structures in this kingdom, is that which took place at the time of the conquest.

The Normans seem, at first, to have entered this country with ideas of fortification quite different from, and inferior to, those of the Saxons. Descended from the Danes they still retained Danish ideas, and considered the high mount as the most essential part of a fortress; as therefore the high insulated hill is characteristic of almost every Danish camp, so the same kind of hill, as the basis of a round tower, is characteristic of all the first Norman castles.

"William the Conqueror," says Stowe, "with an army, went to Nottingham, and there builded a castle; he also went to York, and there caused two castles to be builded, and put in them garrisons; he commanded also castles to be made at Lincoln, and in other places, about the year 1068." We will now see whether the remains of these will not illustrate most fully the Norman mode of constructing such edifices. As to that at Nottingham, the keep has long since been destroyed; it was, however, on a very high and steep hill, from whence was the curious subterraneous passage, still remaining, called Mortimer's hole; but one of these at York, called Clifford's tower, is still in being. Camden gives very little information with respect to it; and merely says, "William the Conqueror built a prodigious strong castle, to keep the citizens in awe;" to which the editor adds, "near the castle stands the shell of Clifford's tower, which was blown up in 1684." This, therefore, which was most evidently the strongest part of the building, having defied the blast of powder, and the injuries of time, was undoubtedly a part of one of the two castles mentioned by Stowe; and being one of the first buildings of the Conqueror, may serve to explain the style first introduced by him.

It is built on the summit of an exceedingly high artificial mount, the sides of which are still so steep, that it can only be ascended by a modern winding path, or by an old steep flight of steps, situated on the side next the other part of the castle. On this side there was originally a drawbridge, passing over the ditch, to afford complete communication; and in the old wall, which enclosed the area of the adjoining castle, there is, though now blocked up, visible signs of a gate.

Situate in this manner, on such an inaccessible eminence, it did not require, nor do we find that it had, the great elevated portal, placed at a great height above the foundations, as we find in the succeeding Norman keeps. On the contrary, this portal stands on the ground, at the brink of the precipice, and at the very brow of the slope and steps that ascended from the drawbridge.

The plan of the tower, *plate* C 66, *fig*. 4, consists of four segments of circles joined together; the longest diameter, from periphery to periphery, being 64 feet; the shortest, from intersection to intersection, 45 feet; and the walls between 9 and 10 feet thick.

From hence it is obvious that no beams for floors could well reach across, though the places for the timbers are still visible in the walls; consequently, they must have had some support in the middle, which was probably either by posts or stone pillars, placed around the circumference of a sort of open well, which afforded both light and air from the top to the bottom, and also the means of drawing up the machines of war to the upper part of the tower.

On the same side as the steep flight of steps and the drawbridge, there is a small square tower, which, Mr. Drake says, was added to the building in the time of Charles I.; but whether it were then a new addition, or a mere reparation, in the room of an ancient turret, it is certain that it was the original and only entrance, *a*, *fig*. 4.

This was defended by a strong massy gate, at the head of the steps, where, before the invention of gunpowder, a single man might make a stout defence against a host; it was then secured at *b* by a portcullis, (a means of defence which seems to have been first introduced by the Normans,) and at *c* by a third and inner gate. Arrived within this we view a large store room, taking up the whole of the ground floor, and having no light but from narrow loops.

At *d* and *e* are two circular stone staircases, ascending to the floor above; there is also an additional small brick staircase at 6, between the first gate and portcullis; but this is manifestly a late addition, and merely built within the body of the little tower, which it much encumbers, as the inner area is only about 10 feet square.

At *f* is the well for water, which still remains entire.

And, according to Drake, there was also a dungeon, so dark as not to take in the least ray of light, but its entrance is now blocked up.

At *k k* were two fire hearths.

And at *g h*, two recesses, or closets.

Ascending the stairs, *d* and *e*, we enter the state apartments, which had large windows, of a singular construction, as represented in *fig.* 5.

At the intersections of the circular parts of the building, were three hanging closets, represented in *fig.* 6. And at the fourth intersection, over the tower of entrance, there was a bedchamber, the outside of which, with its narrow safe windows, is represented in *fig.* 7; where also we may observe the manner in which both loops and windows were contrived, to command the drawbridge and steep ascent of steps before the great portal.

The next castle built by the Conqueror was that of Lincoln: the keep of this castle was situated on a high artificial mount, though not like the former excluded out of the castle area, but the walls enclosing the whole circuit of the fortress were made to ascend on each side the slope, and to join to the great tower; which was, in other respects, in consequence of the steepness of the, hill, and its talus, equally inaccessible both from within the castle area, and from without, except by a steep flight of steps and a drawbridge over a ditch, and therefore was almost as completely insulated as that at York.

It was nearly round, covering, like the preceding, almost all the summit of the mount. But here, as at York, the great portal was still on the ground, protected only by the difficulty of access, in consequence of the steepness of the hill. Indeed, this sort of security was so much depended upon, that we here even find remains of two great portals, one within the castle area to the south-east, and one without to the north-west; so that it is evident, notwithstanding the walls of the castle area adjoin on both sides, that this keep was considered a distinct independent strong hold, equally tenable with the rest of the castle, or without it.

The great portal towards the castle area was not considered as forming any communication between the different parts of this strong hold, except in times of peace and security; and in case of close siege must have been very little used, but safely shut up, and as strongly defended as that on the opposite side, without the castle walls, the one and the other being designed merely for state and convenience, when a numerous retinue were constantly passing in and out. On that side where a communication was really made with the rest of the buildings of the castle, the utmost caution was displayed.

The last castle that we shall mention of the original Norman style is that of Tunbridge. Camden informs us, that it was built by Richard de Clare, about the time of William Rufus, who got it by exchange for Briony, in Normandy; his great grandfather Godfrey, having been natural son to Richard, the first duke of Normandy, and made earl of Ewe and Briony.

The great gate, or tower of

entrance, in this noble pile, was erected long after the first construction of the fortress, and contained more convenient apartments for the residence of a commander-in-chief than are to be met with in any of the original buildings of the age near the conquest.

The entrance was by a strong tower, defended by a drawbridge and deep ditch. From the upper apartments of this tower there still may be traced, very distinctly, the remains of a covered way, leading to a round keep, situated, like those already described, on the summit of a high artificial mount.

Part of the walls of this building are still remaining, and discover far more of its nature and design than those at Tickhill; indeed, it is obvious, that a consistency with the original plan and general device, has been preserved in the very re-edification of the tower of entrance, and in the communication formed between it and the keep, though the former is a building not only of a much later date, but much more complete, than any of the older square towers of entrance hitherto described.

The refinements which the progress of arts introduced, soon caused the lords, who possessed these kind of castles, to begin to consider the residence in the round keep, except merely in time of siege, as a mode of dwelling not so eligible as it had appeared to their haughty ancestors. The large open well in the centre probably began to be thought uncomfortable, and therefore induced them to prefer more convenient and pleasant apartments in other parts of the fortress, where before they had been contented with one single room for state. From hence, however, they still took care to leave a safe retreat to the ancient keep itself, in case of necessity; to which they might retire whenever a close siege commenced.

Plate C 68, *fig*. 1, is a general plan of the whole area of this fortress, to which there were great outworks, with several deep ditches, extending to a considerable distance into the country, and having fine contrivances of sluices and locks for filling them with water; the latter being brought not only to surround the whole castle, but to wash the very foot of the great tower of entrance.

At 1, just beyond the ditch, was a round tower, now destroyed, whereof the foundations still remain under ground, and which served as a barbican to defend the approach.

At 2, a drawbridge, so contrived as when drawn up to rest against the front of the castle, and to close the entrance completely.

a is the great tower of entrance; *b* a high circular mount, rising 70 feet above the present area of the castle, and 100 feet above the bed of the river, its base forming a circle containing almost exactly an acre of land. On the top of this is situated the keep, of an oval form, its longest diameter without being 86 feet, and its shortest 76 feet; and its longest diameter within 64 feet, and shortest 50 feet; so that the walls must have been, in some parts, at least, about 11 or 12 feet in thickness.

It appears from these dimensions, that there must have been a well, or small open area in the centre, with pillars or arches round it, both to support the timbers from the side walls and also to afford air and light.

The mount has been discovered upon examination to have been formed of earth, dug out of the great ditches and trenches which surround the castle, and from the present bed of the river. And to prevent such an enormous mass as the keep, when reared upon such new-made ground, from having any dangerous or irregular settlement, its walls were constructed in a very singular manner; for they were not only of great thickness, and supported by strong buttresses, but compacted with timber wrought up in their substance. It even appeared, upon pulling down the ruins a few years ago, that at about the height of one-third part of the building from the ground floor, there was a continued range of timber, by way of curb, wrought up in the midst of the substance of the wall all round, so that whatever settlement there should be at any time in the ground, the whole must regularly settle together or not at all. It is to be observed, however, that the ground, both within and without the area of this building, has been raised considerably above the original floor, and that the upper part of the wall is now destroyed.

To this keep there were two most extraordinary and well-protected approaches from the other parts of the fortress, which deserve the most minute description.

The one is a covered way from the upper part of the tower of entrance at *a*, along the top of a high wall, which joins that tower to the keep at *b*; but where it terminates at the keep, like that at Lincoln, it never entered either upon the ground floor or upon that next above, but went with a very steep ascent quite to the state apartments, at the top of this building.

The whole nature of it may more fully be understood by *fig.* 2, where *a* represents the tower of entrance, and *b* the lower part of the walls of the keep, and so much of the mount as now remains.

At *d* is the arch, leading from the tower down to the top of the wall, which appears to have been secured by a strong portcullis and an iron door.

From *d* to *e* is the covered way.

At *e* is the foot of the exceeding steep flight of steps, ascending from thence to *f*; but in such a manner that it is manifest they neither ended there nor entered the keep at *f*, but went up a considerable way above the present ruins, where we may be assured there was a doorway, at least as well secured as that at *d*; and so contrived that on any emergency all communication might easily be cut off, even from this covered way.

The wall of communication is considerably higher on the outside of the castle than within; which latter is the side here represented. The ground without is even lower by 26 feet, on the outward north side of the wall, than within on the south, and the buttresses at the bottom of the outward front of the tower of entrance, spread out till they nearly meet the continuation of the foot of the mount, under *w*; in which spot was an open arch that let water in from the outside ditches to a well at *c*. Upon the top of the wall, over this well, appear the marks of a projecting frame-work of timber, made for the purpose of drawing up water on either side, to supply these two buildings; but in all probability there was also a well of water within the body of the keep, as at York, for the service of the garrison in case of a close siege.

The other extraordinary approach to the keep is now in great part destroyed; but it appears to have been from a great round tower, of which the foundations only now remain at the west corner of the area of the castle *c*, *fig*. 1. From this tower it came, as a covered way, upon the top of the wall, about half of the intermediate distance towards the keep, as far as *f*, where was a steep descent, by stairs, to a square subterraneous vault, still remaining most perfectly entire; from thence was a subterraneous ascent leading to the summit of the mount, where it communicated only with the store room, or lower apartment of the keep, and with a small winding staircase within the substance of the wall at *k*; which latter appears to have gone up directly to the leads at the top, and to have had no sort of communication with the state rooms, or any other of the intermediate apartments within.

As, therefore, the former covered way was obviously designed for the use of the governor, or lord of the castle, and his immediate attendants, so we may depend upon it this latter was designed for the use of the soldiers of the garrison, and was their common mode of approach from the tower *a*, and other barracks where they lodged, so long as the area of the castle was preserved from the hands of the enemy, or till they were more closely besieged and shut up in the keep itself. Part of the steps of this ascent were remaining in the year 1742.

In the buttress at *x*, is the appearance of a square pipe, forming a drain to the upper apartments.

At *d* are discovered the foundations of another round tower, and at *g* the remains of a smaller square tower, which seems to have had only two rooms, the one above the other.

At *h* was a sally port, well constructed, and secured with a flight of steps descending towards the river; and between *m* and *n* have been discovered foundations of a range of buildings, which we have good reason to believe were mere additions, made after the time of Edward I.

The walls surrounding the area of the castle are, in general, about 10 feet thick.

At *i i* is the river, but it did not run originally in the present channel, as this latter was made for it at the time the mount was raised, which was in great part composed of the strata of earth dug from thence.

From the corner tower *d* was a strong wall, built across the mouth of the last ditch at *n*, to keep the water to its proper height, and over this wall it found a passage and formed a continual fall; whilst the whole work was well protected by its nearness to the adjacent tower.

At *g* was another large and strong weir; and from some foundations discovered at *p p*, it seems that a tower or other work had, in like manner, been constructed there for its protection.

At a little distance from this weir, to the west of the castle, began a bank, which was carried two miles up the country, through hills and vallies, to enable those who had the care of the castle to fill the mote, at least 14 feet above the level of the valley in the neighbourhood. And to the north, in front of the castle, were two other ditches, at a considerable distance, the one dry, and the other capable of being filled by means of the bank just mentioned; this last was very deep and broad, and passed through the town only at a quarter of a mile from the gate of the castle, where, we have reason to believe, was a drawbridge.

The great tower of entrance, which next claims our attention, is one of the most curious structures at this day remaining in England; and appears, from the style of its ornaments, to have been erected either in the time of king John, or beginning of the reign of Henry III.

Plate C 68, *fig.* 3, is a plan of the ground floor, and of the great portal, through which is a passage to the bass-court of the castle, or ballium. The water of the ditches, as we have before stated, washed the foot of this tower; and at *x x*, in the north front, is the part against which the drawbridge was drawn up.

At 1, appear the places for fixing the windlass to draw up the bridge, and over head, just beneath an arch at a vast height, are three machicolations, for pouring down boiling lead and hot sand on any assailants, in case the drawbridge should at any time be torn down and this first entrance forced.

At 2, was an enormous portcullis, descending from another of the high arches, near the top of the tower.

At 3, a pair of strong gates; and between the portcullis and these gates, that is, between 2 and 3, are three more machicolations, placed under an arch somewhat lower than the former; besides which, there are two narrow loopholes, one on the right hand and the other on the left, from whence any besiegers attempting the second gate might be wounded, even with spears as well as by crossbows.

Between 3 and 4, is a larger area; the arch of which, over head, is perforated the whole way with rows of machicolations, placed at equal distances. At 4, another pair of great gates. At 5, a second portcullis, but not ascending so high in the tower as the former; and at 6, other machicolations, as at the first entrance.

In the middle of the whole passage, on each side, at *a a*, are two small doorways, 4 feet 6 inches in width; they were each of them secured first by a strong portcullis and then by iron doors, and lead to the two apartments on either side the gateway.

Even the inner walls, wherein these doorways are placed, are 5 feet 5 inches in thickness; from whence we may judge of the vast strength of the rest of this building.

The rooms, on each side, are of equal dimensions, being about 28 feet in length, and 15 feet 9 inches in breadth. The passage between, from what was the foot of the drawbridge, to the end next the area of the castle, is about 40 feet; and the gateways are about 10 feet wide. The room on the left hand A had neither chimney nor recess belonging to it, and seems to have served merely for lodging stores; but that on the right B had a large fire place at *f*, and near adjoining to it, in the wall at *g*, a recess, approached from the staircase, which served for a privy, having a very small window at *h*, in the construction of which, it is not a little remarkable how completely it is secured from the possibility of any weapons that might be shot doing mischief to those within.

In both the apartments are

loopholes at *c c*, and at *b b* those already mentioned, all of which are placed so high, that although the soldiers who defended the tower might most easily annoy the assailants without, it was hardly possible for the latter to wound those within.

At *d d*, are two other loops, which being towards the inside of the castle, are made both wider, and in every respect larger for the admission of air and light.

At *e e*, are two circular staircases, well constructed, and arched over head, both of them going quite to the top of the tower, but not descending any lower than this floor. They have, however, as you ascend, recesses in the side wall, leading to the loopholes, which are wonderfully well guarded. These lower rooms were each 13 feet 6 inches in height.

Fig. 4, is a plan of the vaults underneath, which never had any way down to them but by traps in the floors of the rooms just described, and having neither light nor air but what was admitted by two very remarkable narrow sloping flues, opening to the air on the outside, at the height of 9 or 10 feet above the ground, and so small that the one marked *g* is only 1 foot by 10 inches; and the other, marked *h*, only 6 inches in width.

The walls, being thicker near the foundations, render these vaults rather smaller than the rooms above.

At i, is a reservoir of water, that has been made of late years for a sort of cold bath, but, from its being so readily and constantly supplied, we may conceive how easy it was to have had a well formerly in this spot, and may conclude that in all probability there actually was one, either here or at least in some part near adjoining.

At *k k*, are the remains of a strong partition wall; and the floor at *l* appears to have been formerly sunk much beneath the rest, which indicates this to have been the place of the dungeon.

Fig. 5, is a plan of the great apartments on the first floor above, being of just the same dimensions as the rooms on the ground floor, only the height is no more than 11 feet 6 inches.

m m m m, are narrow loops, there being no windows on the outside of this tower next the ditch.

n n n, are three small windows, one to each apartment, looking into the court of the castle, and in the midst of the floor of the recess leading to that in the middle. Just over the inner gateway is the perforation of one of the machicolations.

s s, an open groove for drawing up the inner portcullis, which was worked in this apartment; whilst the grooves of the outer and greater portcullis appear on the outside of the wall at *x x*. It may be remarked, that the whole boarding of the floor of this middle room *p*, was obviously laid on loose, with design to be taken up occasionally, in order to use the machicolations that were formed in the great vaulted arch on the top of which it was placed.

At *o o*, in the rooms on each side, are large fire hearths and chimneys.

At *q q*, the doors leading to the staircases, the steps whereof are still in excellent preservation and well wrought; every one of them being 11 inches in depth. The cause of this great depth seems to have been that they were so contrived as to ascend by one turn only from this floor to the next, and so as to have the first step at 7, and the last step of the turn at 8.

From the staircase, on the

right hand, at *r*, is a passage to a recess, or small room, formed in the thickness of the wall, exactly of the form and dimensions laid down in the plan; from whence at *s* is a passage to an arched doorway at *t*, which appears clearly to have been strongly secured, both by a portcullis and an iron door, and led down to the covered way on the top of the wall that communicated with the keep.

From the staircase, on the left hand, at *q*, is another small passage *w*, leading to a privy, of the same construction with that on the opposite side on the floor beneath; and at *y y*, are the grooves for drawing up the small portcullises over the side doors.

Plate C 69, *fig.* 1, is a plan of the state room above, which appears to have been very magnificent, and of great dimensions, including the whole area of the three rooms beneath. It is now divided into three apartments, but the walls forming the divisions are mere modern erections, raised on the top of the original ones in the lower floor, with a view to fit up a small room as a library, which design has since been laid aside.

At *z*, is a large fire hearth and chimney; and at *t t* are two large windows, highly ornamented in the style that began to be introduced in the time of king John, and earliest part of Henry III.; but they appear to have had no glass, and have been fenced only with iron bars and wooden shutters, as is known to have been the usage in early times.

At *v v v v*, are four narrow loopholes; but there is reason to think that the arches leading to them were shut up as mere closets behind the arras, except on particular emergencies; and that this noble room, when finished and adorned, was no ways disfigured by them; it was no less than 17 feet in height.

The beams of the floor were placed much nearer to each other than those of the floor beneath; indeed they are hardly the width of a beam asunder, and seem to have been intended to support occasionally the weight of a great concourse of people.

The great portcullis, at the first entrance, was drawn up here behind the arras at *x x*, but seems to have been so constructed that, when at its utmost height, it only just filled up, and made level, the cavity left for it in the floor. The dotted part adjoining shows the top of the wall underneath, upon which the floor rested; for on account of the projection of the hanging arches, in the front of the tower, the flat wall in the middle was advanced further out here than in the room below. The ceiling of this room was still more remarkable than the floor, being no less than 3 feet in thickness; designed to support not only the lead of the flat roof, but the great weight of balistas, catapultas, and other engines of war.

In both the front and back walls appear the perforations of the machicolations, going up quite through to the top of the tower, where they were easily approached by means of a set-off in the parapet wall above, and could with more convenience and advantage be made use of than if they had opened into the apartments beneath.

At *y y*, are the doors to the two staircases; that on the right hand merely led directly to the top of the building; but from that on the left, at *o*, is a passage leading to a small room in the wall, of the same proportions and dimensions as here represented; and from thence a second narrow passage *p*, leading to an arched doorway, defended by a portcullis and iron door; and from this doorway was an exceeding steep flight of steps leading down to a covered way, on the top of the adjoining wall, which communicated with the small square tower marked *y*, in the general plan.

At the end of this passage-room was another arch leading to a small recess, serving for a privy, constructed just like the former. On the outside of the tower, far underneath, appears a large arched doorway, answering to one exactly similar at the opposite end of the tower, the use of which, at first sight, is not at all obvious; they were both originally considerably above the level of the ground, and look in every respect like small side portals, as much as those above, defended by the portcullises and iron doors. These being placed on the outside of the walls of the castle give the tower a strange appearance of injudicious weakness; but, odd as it may seem, they are found on examination to have been designed partly for deception, to mislead an enemy by a false outside, and principally to preserve cleanliness; for the sake, first of concealing, and then of easily removing the soil and filth from the easements above, and to prevent its disfiguring the outside walls of the tower, in such a manner as was the case in many other castles, where the outlets to the easements were only loops. Within each of these doors is nothing more than a small square area, excavated out of the wall; the flues descending down to which, from above, are so well constructed and secured, that from this contrivance there could not happen even the least diminution of the strength of the castle, whilst at the same time the external appearance to an enemy could only serve to occasion a most ridiculous kind of deception.

The situation both of the real doorway and of the one for deception, that towards the west is represented in *fig*. 6, where *a* shows the place of the former above the top of the wall, with the steps leading from thence down to the covered way that goes to the keep; and *b* the place of the latter, which is one of the remarkable arches of which we have been speaking, on the outside of the wall next the ditch.

Besides these in the tower, there were more than one necessary, in the small tower at *g*, *plate* C 68, *fig*. 1; another at the top of the steps ascending to the keep at *b*, *fig*. 2; and a whole row of them on the wall from *h* to *d*, besides one or two others between *h* and *c*; the whole of these were so contrived as to cast all filth out of the area of the walls, and to be easily cleansed by means of the river.

We have already mentioned that there was a set-off in the wall on the leads above, at the top of the tower we have been surveying. The wall there is not of half the thickness that it is in all the apartments beneath; and by that means a walk and station for the soldiers was formed all round. On ascending these leads the two circular staircases ended, being covered in with stone arches at top; over which were formed platforms of lead; and over the top of the windows *t t* were two straight staircases, leading from the first leads to those two platforms.

In the parapet wall, all round, were many loopholes; and from some appearance of remains of the lower parts of windows, next the court of the castle, there is reason to suspect that there were also some smaller apartments constructed here.

Plate C 69, *fig.* 2, represents the north front and entrance of the great tower; remarkable for the high arches hanging in a most magnificent manner, one within another, far above over the portal, and containing the first machicolations and groove for the portcullis.

Within the second set of hanging arches, against the letter *b*, were the second machicolations; and the loops of defence are on each side.

There are also two loopholes high above for defending the approach to the entrance.

Fig. 3, represents the inner south front next the bass-court of the castle. The great windows of the state room are richly ornamented, but the other smaller windows, though of the same form, are without the enrichments over head. In the gateway appear the overhanging arches, one within another, but neither so many in number nor so lofty as those in the other front. At 1, 1, are the openings of the small flues in the wall, going down to the vaults beneath.

There now remains but one or two things more to be observed with regard to this extraordinary building: first, there seems to be somewhat of a new improvement in the device of several of the loopholes, for they are formed as represented in *fig.* 4. The lower part of the loop, on the outside, at *b*, descending, by means of a sloping cavity cut in the wall, far beneath the original opening inwards at *c*, and by that means giving a far greater command of the area before the castle to the cross-bow men, whilst, at the same time, it would mislead any one who should attempt to shoot a weapon into it from without; and would direct that weapon in such a manner as to prevent its doing any harm, since it must strike either against the plane *b c*, or against the top *d e*.

It is remarkable, too, that the ornamental arches, forming the entrances to the recesses that lead to these loops, dip below the rest of the wall somewhat in the manner represented at *d*, or even lower, so that although, at first sight, in consequence of the slope *e f*, these loopholes appear more carelessly formed than those at Rochester or Canterbury, yet they are in fact even more fully secured.

The construction of the chimneys also are curious; for notwithstanding they are unavoidably represented in the plan, as if formed by means of recesses in the walls in the usual mode, yet, in reality, the wall at the bottom, behind each fire hearth, is level with the rest of the walls in the several rooms, and only is so formed as to rise up, from thence sloping backwards continually, within the thickness of the rest of the wall, till it reaches the loop of exit, in the manner represented in *fig.* 5, and so as just to afford room for piles of wood to be set up on end leaning against it, under the flue; which mode of construction must have thrown greater heat into the rooms, and have occasioned a better draught up the chimneys.

Further, to avoid weakening the walls too much, the small rooms and recesses formed in them, are no where alike on the two sides of the tower on the same floor, but are placed counter to each other; so that if the wall was at all weakened by the recess on one floor, the defect was made good in the strengthening of the next.

But notwithstanding all these various devices and improvements, and the elegant construction of the whole of the great tower of entrance, beyond what appears in the towers of entrance at Tickhill and Lincoln, yet we may perceive that the general mode of fortification most peculiarly belonging to the Normans, and which was at their first coming introduced by them, has been carefully preserved with all its characteristic marks in every part of the general plan of this curious fortress.

We find the high mount, the round keep on the mount, and the connection of this by a covered way, with the tower of entrance.

There are many castles of this kind of construction in different parts of this kingdom: amongst which we may safely venture to pronounce Trematon castle, in Cornwall, notwithstanding the doubts of the ingenious Dr. Borlase to the contrary to have been a Norman structure of the first age, and to have been built by Robert, earl of Moreton and Cornwall, and half brother to the Conqueror.

Restormel castle, in Cornwall, seems also to have been another structure of the same age. But we agree with Dr. Borlase, in concluding Lanceston castle to be of much higher antiquity, and must place it, both on account of the manner in which the staircases are constructed, and on account of the small dimensions of the area of the inner tower, amongst the very first Saxon castles, and deem it to be even of more early date than Connisborough itself.

Nay, perhaps, we should not greatly err, if we were to venture still further, and to conclude it to have been a work of the ancient Britons, erected in the first ages, in consequence of that great degree of art, beyond the rest of the Britons, which the Cornish men might attain by means of their great intercourse with such foreigners as came from afar to trade for tin.

Whence the rude Picts, the Celtic Britons, the primitive Saxons, or the Normans, all of whose buildings have some distant resemblance, obtained their first ideas of military architecture, so unlike to the Roman, cannot be precisely ascertained; but it is very remarkable what a great similarity there is between this castle at Lanceston, and the description given by Herodotus of Ecbatana, the capital of Media, built in the first ages of the world; and of that part particularly which may be concluded to have been the keep of that ancient and magnificent fortress.

At Lanceston we find, according to Dr. Borlase, three great and elevated circular walls, towering over, and behind each other; namely, that of the first ward, that of the second ward, and that of the innermost ward, or central tower. Besides which, there is, on one part, the outward wall of the bass-court of the castle; which would appear, in many directions, at a distance, as a fourth wall beneath the rest.

It is almost impossible for any one acquainted with ancient history to view these, and not to call to mind what Herodotus says of Ecbatana. He tells us, Dejoces compelled the Medes to come under the polity, and to build a city surrounded with fortifications; and that those strong and magnificent walls, which were known under the name of Ecbatana, were then built. They were, he says, of circular form, one within the other, and each gradually raised just so much above the other as the battlements are high; the situation of the ground, which rose by an easy ascent, being favourable to the design. The king's palace and treasury were built within the innermost circle of the seven which composed the city. The first, and most spacious of those walls, was equal in circumference to the city of Athens, and white from the foot of the battlements; the second black; the third of a purple colour; the fourth blue; and the fifth of a deep orange: all being coloured with different compositions. And of the two innermost walls, one was painted on the battlements of a silver colour, and the other gilded with gold. Having thus provided for his own security, he ordered the people to fix their habitations without the walls of this city.

In this description, surely, we have very nearly a description of Lanceston castle, and the adjacent town; almost the only difference being, that the scale, in one instance, is rather larger than in the other; and that the battlements of the walls of the one were painted with different colours, and those of the other left plain.

We cannot, however, forbear observing, that the judicious Mr. Cordiner concludes most of the duns, or round towers, in Scotland, to have been built by the Danes; and informs us, from good authority, that the Picts were connected with the Norwegians, who, under the command of Harold, assisted them in the endeavour to recover their lost possessions in Scotland. Whence we may infer, that all their buildings had one and the same Celtic origin, jointly with the Norman castles, and with these structures of the earliest times in Cornwall; and certainly they scarcely differ the one from the other, except in such manner as they might well do, in consequence of the slow advancement of civilization amongst the various people who built them.

Having now investigated three successive different methods of constructing these important fortresses, namely, the ancient Saxon, the improved magnificent buildings of Alfred and his successors, and the first Norman piles, we may easily perceive how the next alteration was introduced.

There were but few castles in England before the invasion of the Normans which, as Dr. Barlow observes, greatly facilitated the conquest. William was so sensible of this circumstance, that he promoted the building of new ones with all possible ardour; several therefore were soon constructed, as we have seen, on the original Norman plan, by himself, and certain of his chieftains. But amongst other persons whom he employed and consulted on the occasion, was that great, sagacious, and ingenious man, Gundulph, bishop of Rochester. This extraordinary genius began to reason with more acuteness upon the subject than any architect had done before; and being employed, about the year 1078, to direct the building of the tower of London, and of some other fortresses, he blended together both the excellencies of Alfred's castles, and those of the great round towers of his own countrymen, and added thereto many new inventions, for the sake of increasing not only the security, but also the magnificence, of these piles.

His mode of building was immediately so greatly admired, and so soon came into fashion, that, although the prejudices in favour of the old plan long continued amongst the Normans, and many castles continued to be built according to it, yet many also, in the very same age, and even in the very same year, were erected on Gundulph's plan.

He determined to get rid of the awkward labour of raising high artificial mounts, by way of defending the entrance and approach to the keep, despised the inconvenience of the central wall, for the purpose of affording air and light in the round towers, and saw many defects even in the great castles of Alfred, especially in their want of inward defence to the loopholes in the lower apartments, and in the unguarded design of their great windows above.

In short, to him appears clearly to be due, the honour of the invention of the noble high elevated portal, so completely defended by drawbridges, gates, and portcullises, all placed in the most judicious manner, in lieu of the high mount; the invention of the mode of properly defending loopholes; the invention of wells concealed in the walls, for the purpose of drawing up timbers; the improvement of the manner in which galleries of communications were constructed in the walls; other judicious devices with regard to the situation of staircases, and an improved mode of constructing even the very dungeons.

The noble proportion and disposition of the state apartments, were also another excellence in Gundulph's keeps, as well as the stately mode of approach and ascent to them.

Of the several castles built by Gundulph, we shall particularly enumerate that at Rochester. Rochester castle was in great part re-edified, if not originally built by this great man, about the year 1088, and is one of the finest remains of antiquity in this country. It is true, that part of it is said to have been beaten down in king John's time; but the uniformity of the whole shows that it was most certainly repaired in a manner similar to that of the original construction.

This castle has been built near the brow of a considerable hill, on the banks of the river Medway; and its principal tower, which is 75 feet by 72, is so situated as to command both the river and the whole adjacent country. It was fortified with strong outworks and deep ditches, and had a considerable area around it, enclosed for the use of the garrison.

In the construction of the tower, the circumstances most manifestly endeavoured to be provided for by the architect, were,

1st. The security of the entrance, and the rendering of it difficult to an enemy, but so magnificent as to be suitable to the dignity of the person who, as commander in chief, was there to have his residence.

2dly. The protection of the whole garrison in case of a close siege, so that they might neither be annoyed by the weapons of the enemy, nor be subject to have their apartments set on fire; at the same time taking care to devise such means as would enable them to annoy the besiegers with safety to themselves.

3dly. The contriving to mislead and deceive the besiegers, and to draw their attacks upon such parts of the building as were in reality the strongest, and the least liable to be injured by them.

4thly. The security of the stores, and the securing of the prisoners, in such a manner as to need no very considerable guard.

5thly. The easy conveyance of the great engines of war, such as balistæ, catapultæ, warwolfs, and other offensive weapons, into the various apartments, and up to the top of the tower.

6thly. The means of giving a quick alarm to all the garrison, without producing confusion, or suffering the enemy to be apprized of it.

7thly. The supplying the garrison with water.

8thly. The conveying away the smoke from the apartments, and the forming of drains to carry off the filth.

And lastly, the providing a habitation for the commander in chief, or lord of the castle, both stately and airy, and free from the annoyance of the enemy's instruments of war. These ends were obtained by the most ingenious devices. *First*, as to the entrance, nothing can be conceived more completely adapted to answer the double purpose both of state and security. It was not in this castle, nor indeed in any other ancient castle that I have seen, says Mr. King, that the entrance was either in the lower story or upon the ground, or near to it, but at a considerable height by means of a grand staircase, which went partly round two of the fronts of the castle on the outside, and terminated in a grand portal. But, before this portal could be entered, there was a drawbridge to be passed, the pulling up of which cut off all communication with the flight of steps; and there was also a strong gate about the middle of the staircase, between the foot of it and the drawbridge. Nor was this the only security, for even the grand portal, beyond the bridge, was not the real entrance of the fortress, but merely the entrance of a small adjoining tower, the whole of which might be demolished without any material injury to the body of the castle. Within this little tower was a sort of vestibule, and from thence was a second entrance (the real entrance of the great tower itself), through a second portal, placed in the thickness of the wall, which was here about 12 feet thick; and this second entrance, as well as the first portal, was defended by a portcullis, or herse, sliding in a strong stone groove, and also by a strong pair of gates; so that there were three strong gates to be forced, and two portcullises to be destroyed, before this entrance could be gained; and one pair of gates was to be broken down, and the drawbridge at a great height to be replaced, before even the first portcullis could be approached.

How strong the mode of fortifying by means of the portcullis was before the invention of cannon, is so well known, that it is almost needless to describe it; but as it will tend to explain some other parts of the building, we will just mention, that the herse, or portcullis, was a strong grating of timber, fenced with iron, made to slide up and down in a groove of solid stone work, within the arch of the portal, just as a sash window does in its frame, and that its bottom was furnished with sharp iron spikes, designed both to strike into the ground or floor, for the sake of greater firmness and solidity, and to break and destroy whatever should be under it at the time of its being let fall. Its groove was contrived so deep in the stone work, that it could not be injured or removed without pulling down the whole wall.

The remains of the grooves of both the portcullises, in both the portals we have described, and the places for working them in the rooms above are still visible, as also the remains and places of the hinges of the gates. We may also perceive that, for state, there were in the thickness of the wall, at the second entrance, two stone seats in large niches for the warders, or for those who by military tenure kept castle guard.

Besides this grand entrance there was none other of any consequence, and indeed there was no possibility of getting in or out the castle otherwise than by it, except by a small sally port, or narrow doorway, situate directly under the drawbridge, and therefore in a place where any assailants might easily be annoyed, both from the top of the stone steps and from the first portal, and if there were any machicolations over that portal by them also. This little sally port was at such a height from the ground that it could only be approached by a scaling ladder, as it had neither stone nor other fixed steps. And lest even this entrance, thus secured, should be forced, provision was made within the castle that it should give no easy admittance to the main body of the building; for, from hence, to the grand entrance in the apartments of the floor above, there was no ascent, except by one small winding staircase, although, in the next story, there were no less than three convenient staircases leading to the upper apartments of the castle. This staircase was so narrow that a single sentinel could easily defend the passage; it was also well secured by strong doors.

Fig. 1 and 2, *plate* C 70, are plans of the tower; the first being designed to represent the floor where the grand entrance is situate, at the top of the flight of steps; and the second a plan of the floor above, which contains the state apartments.

Fig. 3 is an elevation of the tower on the north-east side, together with the smaller tower with which it is connected, and in which is the vestibule and grand entrance.

In *fig.* 1, *a b c* is the grand flight of steps, the bottom being at *a*. At *f*, on the first landing, was a strong arch over head, and a great massy gate; and at *d* was the first grand portal, fortified by a strong gate and portcullis. Between *c* and *d* was the drawbridge; at *e* was the vestibule; and at *g* the second grand portal, fortified also by another gate and portcullis. At *h* are the great niches on both sides the wall, with stone benches for the warders, or those who kept castle guard at the gates.

In the plan of the ground floor at *i*, *fig.* 2, is the place for working the herse, or portcullis, over the last portal; and at *k* is the place for working the portcullis over the first portal. The approach to the first mentioned was from a gallery within the thickness of the walls; and the approach to the second was from the former, and through the chamber over the vestibule.

In *fig.* 3, 1 and 2 show the remains of the grand staircase;

4 the grand portal, the bottom of which, notwithstanding the soil and dirt that has accumulated round the castle, is still 20 feet from the ground; and at 3 is the sally-port still at the height of 7 feet, so that we may conclude that it was in former times still more. Over this was the drawbridge.

The present entrance to the castle is through a modern breach made in the wall at a place where there was originally a loophole; it is represented at *l, fig.* 1. At *m* is the only staircase leading to the ground floor; and at *n* and *o* are two other staircases, commencing at this floor, where the grand entrance was formerly situate, and thence leading to the top of the castle.

Secondly. The contrivances in the structure of this tower for the protection of the garrison in case of a close siege, and after the outworks should be taken, were most remarkable, and the methods devised to secure them from being annoyed by the enemy's weapons, and yet to enable them to annoy the besiegers, were most curious, and are well deserving our attention.

On the ground floor there were no windows, and but few loopholes, and even these were exceedingly small, not being much above 6 inches square. On the north-east side there was absolutely none, and on the other sides only two at the most; their structure and situation being such that no weapon could possibly enter far enough to fall into the apartments, nor could any firebrand be thrown in to do mischief, or reach further than the bottom of the arches, through which these loopholes were approached from within the castle; nor were there any other beside loopholes in the story above, where the grand portals were situate.

The third story contained the rooms of state, and although there were, indeed, in these rooms, most magnificent windows, yet they were placed so high in the apartments, which were on that account exceedingly lofty, and were so peculiarly contrived that it was almost impossible for any weapon to be shot into the room to do any mischief. If the weapon entered in an ascending direction it struck against a low arch and could not enter the room; and if it was shot with such force, and from such a distance, as to enter the room nearly horizontally, it must then have force also to go quite across the room, at a great distance over head, and most probably would lodge in the arches of the wall on the opposite side, so that it was hardly possible for a weapon to have fallen into the room, and if perchance it did so, it must have been after it had struck the opposite wall and lost its force.

But, in order to understand this the more fully, it is necessary to have recourse to some diagrams. *Fig.* 4, *plate* C 70, shows the front view of an arch on the ground floor, in the thickness of the wall, and its correspondent loophole, as seen within the castle; and *fig.* 5, *plate* C 71, is a section of the same.

The loophole is placed at the end of an arch cut through the wall, which, in this part, is at least 12 feet in thickness The hole is placed at the very top of the arch, and is approached by a flight of steps, which do not begin till you have advanced some little way under the arch; and the loophole, by means of a rising in the vaulted roof, at the further end, is not only placed at the top of the arch, but in reality considerably above the vaulting at the entrance: so that whatever weapon, or stone from a crossbow, or firebrand, or firearrow, was shot in by the besiegers, it must strike against the rising part of the vaulting, and fall down within the arch, without a possibility of doing any great injury. It could strike no one unless it were a crossbow man, who might at that very instant be at the loophole within the castle, going to shoot at the enemy, and even he must place himself very awkwardly to be struck by it; for these loopholes, though the lowermost in the castle, are yet so high from the ground, that any weapon from without must ascend to enter them; and as to any firebrand, or firearrows, shot in, it is plain that such must fall down within the stone arch and there remain.

Another circumstance that deserves notice is, that whereas the wall might appear to have been weakened by these arches, yet the steps so strengthen it, and there is so great a thickness left, even close round the loophole, that not the slightest danger could be apprehended from that account.

Thus was the lower floor protected; which, both on account of its strength and darkness, was in general designed merely to hold the stores.

These lower rooms (for there were two of them) reached from the ground to a little beneath the bottom of the drawbridge and grand portal, so that their height was at least above 14 feet.

The next rooms reached in clear height above 20 feet more, almost to the lower range of loopholes, seen in *fig.* 3; it is therefore plain, that on this floor, which contained the principal entrance, there were no windows, nor lights, nor even loopholes, on the same side with the entrance. The reason of this is obvious, for had there been any they would have been too much exposed to the enemy when they had made themselves masters of the steps, or were making an attack upon the portal.

It is, however, to be observed, that in the vestibule, in the small tower, on this very floor, there are large and handsome windows; but then this vestibule seems to have been considered as a place of very little importance in a close siege, and where none of the garrison would be found. The portcullises of both portals were worked in or near the room above, and in that room, though so much higher, there are only loopholes; the disposition of the loopholes and the windows of this small tower being in an inverted order from those of the great tower.

The large and elegant windows in the vestibule, added to the stateliness of the entrance, occasioned therefore no sort of danger to the garrison.

This second story, though it had no other large windows than those in the vestibule, had however loopholes on all the sides, except that to the north-east, and being so much higher they were allowed to be larger than those on the ground floor; in other respects they were contrived much in the same manner, only that instead of steps there was a stone stage, within the arch wall, on which two crossbow men might stand. (See *fig.* 6, *plate* C 71.)

On this floor was the guard chamber; and here the chief part of the garrison had their residence and lodging. Within the wall also, at the north corner, is a small room with a fire-place, which seems to have been the station of some officer who commanded the guard. Its situation may be seen at *p*, *fig*. 1, *plate* C 70.

To us, in this more refined age, it may naturally seem astonishing how so great a number of men could find lodging in such a building; but an anecdote, which we will, on good authority, relate of the family of lord Lovat, (who was one of the last chieftains that reserved the rude manners and barbarous authority of the feudal ages,) may, perhaps, give us some idea of their manner of dwelling. "This powerful laird resided in a house which would be esteemed but an indifferent one for a very private, plain, country gentleman, in England, having, we believe, only four rooms on a floor, and those not very large. Here, however, he kept a sort of court, and several public tables, and had a numerous body of retainers always attending. His own constant residence, and the place where he received company, even at dinner, was in the very room where he lodged; and his lady's sole apartment was her bedroom; and the only provision for the lodging of the servants and retainers was a quantity of straw, which they spread every night on the floors of the lower rooms, where the whole of the inferior part of the family, consisting of a very great number of persons, took up their abode."

The next floor to this, or third story, contained the rooms of state, and was about 32 feet in height, taking in the lowermost range of loopholes, and the magnificent windows above.

The loopholes were contrived just like those last mentioned; but, in all probability, the arches, through which they were approached, were concealed behind the arras, with which, according to the custom of the times, these rooms were hung; and the great windows were placed at such a vast height in the rooms, and so far from the ground, that any weapons shot in must, in all probability, on that account alone, strike against the top of the arches that were cut in the wall to give light from these windows. The vaulting of these arches was purposely placed so low, and so near to the top of the windows, that, large and magnificent as they were, it was nevertheless almost impossible for any weapons shot in to reach the ceilings of the rooms, or considering the thickness of the walls, even to come into the rooms at all.

It also deserves notice that, for the convenience of the garrison, in case of a close siege, and that orders might be speedily communicated to all parts, there was on this floor, within the thickness of the wall, in the space between the loopholes and the windows, a gallery, as represented by the dotted lines in *fig*. 2, which in different places ascended and descended by means of steps. From this gallery, and the staircase at *m*, there was an easy communication both with the great cavities in the walls at *i* and *k*, where the two great portcullises of the two portals were worked, and also with the chamber over the vestibule. Besides these, there was, in the floor above, a smaller and narrower gallery, within the thickness of the wall.

As to the fourth or uppermost story of all, the rooms of which were about 16 feet in height, there was no need of any precautions in the structure of the windows. It had, therefore, very large ones, like the grand apartments, and these were not far from the floor. The rooms here, as well as the leads of the castle, were occasionally used for the catapultas, balistas, warwolfs, and other instruments of war, to annoy the enemy, and were the places from whence the soldiers most conveniently attacked the besiegers. From these rooms there was a door which opened upon the leads of the small tower, as may be seen in *fig.* 3, on which instruments of war might also be placed.

Thirdly. It was customary in ancient castles to endeavour to draw the attention of the besiegers from the weakest part of the buildings by giving to some parts that were much stronger a still greater appearance of weakness. In the castle under consideration, the first, and most remarkable, was a stone arch and false portal on the staircase, just by the first gate *g*, *fig.* 3. Its appearance, certainly, could answer no other end than to deceive and mislead the besiegers, by inducing them to attempt a breach in this place, when once they had made themselves masters of the steps and of the first gate; for any one who looks at the north-east front of this building, would instantly conclude, that there was formerly an ancient entrance at this place; but upon carefully measuring and examining the inside of the castle it will be found that this imaginary entrance is directly against the most solid part of the transverse wall, being not only against the side of the solid north-east wall, which is here 12 feet thick, but moreover against the end of the north-west wall at N, *fig.* 1. It may also be observed, that the small apartment *p*, before mentioned, as being at this north corner, is above the crown of the arch, and consequently could not diminish the strength of the wall of this false portal.

That deception alone was designed by the construction of this arch appears the more probable, because in Dover castle there is a similar great arch and false portal, situated in a somewhat similar manner, and another small false portal on the ground, on the the south side, which, on examination, is found to be not only against the whole thickness of the wall of that front, but also directly against the end of the strong partition wall in the middle, that separates the rooms of that castle. Something of the same kind may also be observed in the castle at Norwich, where the two great arches on the ground on the west side, which have often been supposed ancient entrances, and at least appear weak places, are in reality the strongest parts of the walls.

The next deception was the round tower at the south angle *s*, *fig.* 1; and here, as well as by the false portal, many late observers of this building have been deceived, just as the besiegers were intended to be; for it has been taken for granted, that this was a weak part of the building, and that this tower was raised to strengthen it. Indeed it appears on the outside that this round tower might, at any time, be more easily battered down than any other part of the castle. But whoever attempts the experiment, will soon discover his error; for though it has loopholes, and seems on the outside to be a very injudicious structure, it is, in reality, almost a mass of solid stone, having no cavities, except a narrow passage, and a dark room or cell, at the bottom, of very contracted dimensions. The dungeon for the reception of prisoners, was invariably attached to the old English castle; in Rochester Castle it was beneath the small square tower adjoining the keep; in others it lay under the keep itself. It was entered by a narrow and steep flight of steps in the wall. Air was admitted only by an aperture in the roof, which was secured by a falling or trap-door. Within the massy walls of this castle, there are three square wells, which open at the bottom on the ground-floor, and are carried to the top of the building, having in their ascent branches of passage leading to galleries on the two upper floors. It is believed that such cellular passages within walls, first occur in the castles of bishop Gundulph, and were probably intended for quick conveyance to the ramparts and top of the castle. The principal castles built on the plan of bishop Gundulph, are, Canterbury, Dover, Ludlow, Richmond in Yorkshire, and Hedingham in Essex.

The reign of Stephen is most celebrated for the erection of castles during the prevalence of the mixed Anglo-Norman style. The castle of Newark in Nottinghamshire is a fine specimen of the castellated antiquities of the twelfth century. It is believed to have been erected by Alexander bishop of Lincoln, and the original and most important parts of it still exist. It occupied a large oblong square, on a high bank by the side of the Trent; the keep appears to have been in the centre of one of the ends; it is of an oblong form, and consists of three stories. On the ground-floor are two rooms, without either window or loop-hole; in one of these was a well, and a recess leading to a dismal dungeon. Next above was the principal room, which was entered by a covered way from the adjoining wall. The grand staircase of the keep commences on this floor, and leads to the state apartments, which are immediately above. These were small, and chill in aspect; but the principal room was lighted by a large and handsome window. The outer staircase proceeded from the base of the inner court, to the battlements and top of the building, having no communication with the apartments of the keep: smaller towers appear to have been placed at each corner of the fortress, one of which yet remains. The castle of Tiverton in Devonshire is an interesting specimen of the time of Henry I. Amongst the strongest castles of the reign of Stephen were Norham in Northumberland, Sheriff-Hutton in Yorkshire, and Brancepeth in Durham. The persons most distinguished in the time of Henry I. and Stephen, for castle building, were Roger bishop of Sarum, and Alexander bishop of Lincoln. The former is particularly celebrated by contemporary historians. He built or much enlarged the castles of Malmsbury, Devizes, Sherborne, and Sarum. He was the first who in his buildings joined the courses of stone so nicely together, that, according to William of Malmsbury, "the joint deceives the eye, and leads us to imagine that the whole wall is composed of a single block."

The last specimens of castellated architecture, between the reigns of Stephen and Edward I. are Knaresborough and Beeston castles; both of them very irregular piles, the latter of which consists of circular towers.

About the time of the first Edward, in the thirteenth century, a more magnificent style was introduced, with numerous towers, splendid and capacious halls, and occasionally the appendage of religious houses. The castle of Caernarvon was built by Edward after his conquest of Wales in 1282, and the external walls yet remain; two sides of which were originally defended by an embattled terrace, extending to a deep water; a fosse fronted the remaining sides. The walls are from eight to ten feet in thickness, surrounded by an enclosed passage, with narrow loop-holes. Above the embattled parapet, arise, in majestic grandeur, numerous turreted towers, not uniform, but pentagonal, hexagonal, and octagonal; with three others to the north, two rising higher than the rest. The Eagle Tower has a stone carving of that bird, with three elegant turrets, and is remarkably beautiful. There is a peculiar grandeur in the principal entrance on the east; and beneath a tower, on this front, is a statue of Edward, in a menacing posture, with a sword half-drawn in his hand. It may be seen, by the grooves in the gateway, that it was defended by four portcullises. The Queen's Gate is considerably raised above the moat, and only accessible by a drawbridge. There is a deep well in the north-east corner, contiguous to a round tower, over a dungeon.—Such is the delineation of Caernarvon Castle, founded on a rock, and remaining almost entire. Within is an irregular, oblong area, with two walls, forming an outer and inner court. The remains of spacious windows and elegant tracery distinguish the state rooms, which present a square front, but are all polygonal internally. About 70 yards remain, of a covered passage, originally extending round the interior of the castle; the only remaining staircase, is that of the Eagle Tower, whose summit commands an extensive view of the surrounding country, and the isle of Anglesea. Edward the Second is said to have been born in a little dark room in this tower, in which there is a fire-place; but the adjoining central, spacious apartment, on the same floor, has more probably been the place of the royal accouchement.

Conway Castle is another of Edward the First's erection, supposed by the same architect as the preceding, and built in the year 1284. A more beautiful fortress, perhaps, never arose; certainly England does not contain its equal; but it is in a ruinous state. The heap of rubbish in the river, is all that remains of the round tower, which terminated a curtain rampart intended to prevent the enemy's approach from the river; a similar tower at the opposite end of this wall is also destroyed. Part of a tower on the south side yet remains, hanging over the foundation rock in an oblique direction. The form of this castle is an oblong parallelogram, extending along the verge of a precipitous rock, washed on two sides by forked branches of the river; the other fronts face the town. The walls are of great thickness, flanked by eight vast, circular, embattled towers, each with a slender turret, machiolated, rising from the top, ascended by a spiral staircase, and used as a watch-tower. The two principal gates are admirably contrived for security: the grand entrance was at the north-west end, by a drawbridge, over a fosse, deep and wide; the other was from the river, through a small advanced postern; the common entrance was on the north-east, by a steep and winding path. Except the state-hall, few of the apartments are distinguishable; its length is 30 feet, the breadth nearly the same, and the height 20 feet: the roof was supported by eight arches, only four of which now remain. It had two fire-places, and was lighted by six narrow windows toward the river, and three larger toward the court. Underneath were extensive vaults, for arms, ammunition, and military stores. Opposite the principal gateway are two towers, one called the King's, the other the Queen's; these contained several rooms each; the latter had a recess in the wall, with a groined roof, the ribs of which divided the whole into six compartments, with seats, and lancet windows; it was called the *Oriel*, or queen's toilet-room.

Caerfilly Castle, in Glamorganshire, in the centre of an open plain, seems rather the ruin of a small town, than of a castle; it is said to be the largest ruin in Britain. The high outer rampart, with its massive abutments, and numerous towers, is yet nearly entire, and gives a striking idea of its extent. In surveying this ruin, we pass the barbican, now formed into habitations; and proceeding between two ruined towers, enter the great area of the castle. To the right is a range of buildings; the barracks and garrison, under the rampart; the citadel, hall, chapel, state-rooms, and other apartments, constituting what was properly termed the castle. With difficulty passing over the fragments of another drawbridge, and its auxiliary towers, we approach the first court, and thence through a large gateway, with several grooves for portcullises, to the principal court of the castle, the area of which is 70 yards by 40. On the southern side is a princely apartment considered to have been the hall; by some believed to have been the chapel. But whichever it may have been, its ruin yet retains vestiges of great elegance, in the outlines of its four large windows, the grand proportions of the chimney-piece, and the light triplet pillars, with arches surrounding the room. The outward staircase entrance to this splendid apartment, the vaulted roof of which was supported by 29 arches, is in the most ruinous state. From this place is seen, to the east, a leaning tower, between 70 and 80 feet high, of prodigious thickness; it hangs nearly 11 feet out of the perpendicular, held together only by the strength of its cement. It has remained in this state many centuries. Near this part of the building, is a place called the Mint, with furnaces for melting metal. The corridor is yet in a good state of preservation, lighted by small windows, and, passing round the principal court, it formed a communication with the different apartments. The western entrance with its ponderous circular towers, venerably shaded with ivy, is remarkably striking; and, with the remains of its drawbridge and defensive outworks, may be considered the most entire part of the ruin. The æra of the building of this castle is believed to have been near the close of the reign of Edward the First.

The re-edification of Windsor castle, about the year 1350, by William of Wykeham, led to the introduction of a more splendid style of building among the nobles; of which Harewood House and Spofford in Yorkshire are instances: also Nayworth in Cumberland, and Kenilworth, one of the most picturesque objects in the kingdom, give a tolerable idea of the magnificence exhibited in the princely and noble buildings of this age. Sir John Fastolf built his country residence at Caistor in Norfolk, in

1459, which gives us the style of the reign of Edward VI., after which succeeded houses *ornamented* with turrets and battlements. Haddon House, described by Mr. King, in his Archaiologia, vol. vi. page 347, is the best remaining specimen of these fantastical buildings.

Caster, Chester, or Cester, When they occur either as the whole, or as part of the appellation of places in Great Britain, prove them to have been fortified and inhabited by the Romans.

Castra, Castramentations, or Castella. The Roman fortified camps, or stations. The Roman camps were commonly divided into *castra hyberna*, and *castra æstiva*, winter and summer camps. They were often placed on the site of British settlements, and consequently preserved the irregularity of form which usually prevailed amongst the Britons. Instances may be observed at Silchester, Kentchester, Bath, Canterbury, &c. The cause of this irregularity will very generally be found to be the peculiar circumstance of the situation. As to the usual situation of their camps, "There is nothing," Horsley observes, "that the Romans seem to have had a greater regard to, than the convenience of a river, and perhaps, too, the additional strength which it afforded. For the benefit of the meridian sun, which they must need who came from so much warmer a climate, they usually had their stations and outbuildings on the north side of the rivers, and on a gentle declivity. In some instances they chose higher ground, for dryness and prospect. And, as often as they could, they seem willing to have joined these together. From these circumstances of form and situation, the Roman camp may in general be distinguished from that of the other nations connected in a military capacity with this island." The term *station* applies to such *castra stativa*, or fixed camps, as were used for the permanent quarters of detachments of the Roman forces. The regular and great stationary camp was encompassed by a lofty and massive wall, composed sometimes of stone, and at others of stone, flint, and brick mingled, and surrounded by a deep single or double fosse. At Richborough, where some portion of the walls are still remaining, on the north-east they are in some parts nearly 30 feet high from the ground, and in many others about 23: the thickness at bottom is generally from 11 to 12 feet, and in some parts even 13. It is constructed of regular facings of alternate rows of squared stone and brick on the two outside surfaces; but, within, between these two uprights, it is composed merely of chalk, rubble, and flints, thrown in carelessly, with cement, or mortar, spread over them at proper distances, so as to sink into the whole mass. The Romans were quite neglectful of minute precision in disposing the form and lines of their camps: the sides are often of an unequal length, and not straight, or set square. On the line of wall which enclosed the camp, are sometimes discovered the remains or foundations of circular towers. These frequently occur at the angles, or on each side of the gate. But these towers appear to have been added to the walls after their first erection; as it is probable that the Roman stations in Britain were originally constructed without such means of defence. The gates were generally four: the *prætorian gate*, in front of the camp; the *decuman gate*, on the opposite side, so called from its being wide enough to allow ten men to pass abreast; and the two *principal gates*, one on each side of the oblong encampment, at the extremities of the principal street of the camp.

The internal arrangement was made with great judgment and care. When the outline was complete, the standard was erected by the general on the spot chosen for the site of his tent, which was usually on the highest ground. This was the point of admeasurement; around it was marked off a square of 200, or, according to King, 400 feet, for his occupation, and stiled the *prætorium*. It contained the general's tent, with a neighbouring *sacellum*, and *augurale*, with a parade or court. In numerous instances a Christian church is found to have been erected on or near that part of the Roman castramentation occupied by the *prætorium*, and probably engrossing more particularly the portion once appropriated to pagan worship. This may be instanced in the cathedral of St. Paul, at London. A line was then drawn before the *prætorium*, at the distance of 50 feet, running entirely across the camp. Within it, to the right and left of the prætorium, were placed the tents of the twelve tribunes, six on each side. Beyond the tribunes, and equally divided on each side, were the tents of the twelve prefects of the allies. About 100 feet from the first line was drawn another, reaching across the camp, and the interval formed the chief street of the camp, called *principia*, or *principalis*, with the two principal gates at its extremities. In a straight direction from the central point of the front of the prætorium, another street, fifty feet wide, ran through the body of the camp, on the sides of which were placed the cavalry, and directly behind them the foot. Five hundred feet from the *principia*, and parallel to it, another street, fifty feet in width, called *Quintana*, stretched across the whole encampment. On the right and left of the *Triarii*, the veteran foot, encamped beyond the cavalry of their respective legions, two streets, each fifty feet broad, extended from the principia to the front of the camp, or that part most distant from the prætorium, on the sides of this street were placed the principes, who had a space allowed them of 100 feet square. On the right and left of the principes, were stationed the *Hastati*, who fronted two other, and more outward streets, each fifty feet broad, and running the whole length of the encampment. On the opposite sides of these streets were quartered the cavalry of the allies. Between the cavalry and the vallum or rampart of this entrenchment, were stationed the allied foot. Mr. King supposes, in opposition to the opinion of General Roy, that a regular street, 50 feet wide, ran between the allied cavalry and foot in each wing. Behind the prætorium ran a street 100 feet broad across the camp, and parallel with the tents of the tribunes. Between it and the tribunes' tents, was a space on each side, of the same breadth as the prætorium. On one side an area formed the *market-place*, or *forum*; and on the opposite side of the prætorium was a quarter assigned to the *Quæstor*, and near him depositions of arms, clothing, and provisions. Beyond these were the *ablecti*, or select horse of the allies, with the *evocati*, and volunteer horse; behind them the *evocati* and volunteer foot, and between these and the entrenchment the select foot of the allies. From the central part of the prætorium, a street fifty feet wide ran to the decuman gate. On both sides of this street were the extraordinary horse and foot of the allies. Between the tents and the entrenchments, on each side of the camp was left a space of 200 Roman feet.

The above description of a Roman castramentation applies to the consular camp, for two legions, with their auxiliaries, amounting in the whole to about 19,200, according to the description of Polybius. In later periods of the empire, some variation in the Roman camp took place, but it chiefly related to the dimensions, and to the internal organization of the temporary camp.

The Roman stations in Britain, mentioned by Richard of Cirencester, are: -Rhutupis, now *Richborough*; Durovernum, *Canterbury*; Durosevum, *Ospring*; Durobrivæ, *Rochester*; Londinium, *London*; Sulomagus, *Brockley Hill*; Verulamium, *Verulam*; Forum Dianæ, *Dunstable*; Magiovinium, near *Fenny Stratford*; Lactorodum, *Towcester*; Isanta Varia, *Burntwalls*; Tripontium, near *Lilburn*; Benonis, *High Cross*; Manduessedum, *Mancester*; Eteocetum, *Wall*: Pennocrucium, on the *Peak*; Uxaconium, *Red Hill, Okenyate*; Uriconium, *Wroxeter*; Banchorium, *Bander*; Deva, *Chester*; Varis, near *Pont Ruffin*; Conovium, *Caer Hun*; Segontium, *Caer Segont*; Hereri Mons, *Tommen y Mur*; Mediolanum, *Clawdd Goch*; Rutunium, *Rowton*; Durositum, near *Rumford*; Cæsaromagus, near *Chelmsford*; Canonium, near *Kelvedon*; Camulodunum, *Colchester*; Sturius Amnis, *on the Stour*; Cambretonium; Sitomagus; Venta Cenom, *Castor near Norwich*; Camboricum, *Cambridge*; Durolispons, *Godmanchester*; Durnomagus, *Castor*; Isinnis, *Ancaster*; Lindum, *Lincoln*; Argolicum, *Littleborough*; Danum, *Doncaster*; Legiolium, *Castleford*; Eboracum, *York*; Isurium, *Aldborough*; Cattaracton, *Catterick*; Ad Tisam, *Pierce Bridge*; Vinovium, *Binchester*; Epiacum, *Lanchester*; Ad Murum, *Halton Chester*; Alauna Amnis, *on the Coquet*; Tueda Flumen, *on the Tweed*; Ad Vallum, *the Wall*; Curia; Ad Fines, *Chew Green*; Bremenium, *Reichester*; Corstopitum, *Corbridge*; Vindomora, *Ebchester*; Derventio, near *Stamford Bridge*; Delgovicia; Preturium, *Flamborough Head*; Calcaria, *Tadcaster*; Cambodurum, *Slack*; Mancunium, *Manchester*; Fines Maximæ et Flaviæ, *Stratford*; Condate, *Kinderton*; Portus Sistuntiorum, *Freckleton*; Rerigonium, *Ribchester*; Alpes Peninos, *Burrens*; Alicana, *Ilkley*; Lataris, *Bowes*; Vataris, *Brough*; Brovonacis, *Kirby Thur*; Vorreda, *Plumpton Wall*; Luguballia, *Carlisle*; Trimontium, *Birrenswork hill*; Gadanica; Corium; Alauna, *Kier*; Lindum, *Ardoch*; Vittoria, *Dealgin Ross*; Ad Hiernam, *Strageth*; Orrea, *on the Tay above Perth*; Ad Tavum, near *Invergowrie*; Ad Æsicam, *Brechin on South Esk*; Ad Tinam, *Fordun*; Devana, *Norman Dykes*; Ad Itunam, *Glentmailin on the Ithan*; Ad Montem Grampium, near *Knockhill*; Ad Selinam, *on the Cullen, near Deskford*; Tuessis, *on the Spey, near Bellic*; Ptorotone, *Burgh head*; Varis, *Fores*; Ad Tuessim, *Orondall on Spey*: Tamea, *Braemar Castle*; *Barra Castle on Ila*; In Medio, *Inchstut hill*; Brocavinocis, *Brougham*; Ad Alaunam, *Lancaster*; Coccium, *Blackrode*; Mediolanum, *Chesterton*; Salinæ, *Droitwich*; Glevum, *Gloucester*; Corinum, *Cirencester*; Aquæ Solis, *Bath*; Ad Aquas, probably *Wells*; Ad Uxellam, probably *Bridgewater*: Isca, *Exeter*; Ad Abonam, *Bitton*; Ad Sabrinam, *Sea Mills*; Statio Trajectus *Severn Side*; Venta Silurum, *Caerwent*; Isca Colonia, *Caerleon*; Tibia Amnis, *on the Taaf*; Bovium, *Ewenny*; Nidum, *Neath*; Leucarum, perhaps *Lughor*; Ad Vigesimum, *Castle Flemish*; Ad Menapiam, *St. David's*; Verlucio, *Highfield near Sandy lane*; Cunetio, *Folly farm, near Marlborough*; Spinæ, *Spene*; Calleba, *Silchester*; Bibracte; Bultrum, *Usk*; Gobannium, *Abergavenny*; Magne, *Kentchester*; Branogenium, near *Leintwardine*; Blestium, *Monmouth*; Sariconium, *Berry hill*; Ad Antonam, *on the Avon*; Alauna, *Alcester*; Chestuton; Ratis, *Leicester*: Venromentum, *Willoughby*; Margidunum, *East Bridgeford*; Ad Pontem, near *Thorpe*; Crococolana, *Brugh*; Vindomis, near *St. Mary Bourne*; Venta Belgarum, *Winchester*; Ad Lapidem, *Stoneham*; Clausentum, *Bittern*, near *Southampton*; Portus Magnus, *Portchester*; Regnum, *Chichester*; Ad Decimum, *on the Arun*; Anderida Portus, *Pevensey*; Ad Lemanum, *on the Rother*; Lemanianus Portus, *Lymne*; Dubra, *Dover*; Regulbium, *Reculver*; Madus, *on the Medway*; Vagnaca, *Barkfields in South Fleet*; Noviomagus, *Holwood Hill*; Brige, near *Broughton*; Sorbisdunum, *Old Sarum*; Venta Geladia, *Gussage low Town*; Durnovaria, *Dorchester*; Moridunum, *Seaton*; Durius, Amnis, *on the Dart*; Tamara, *on the Tamair*; Voluba, *on the Fowey*; Cænia, *on the Fal*; Sylva Anderida, *East Bourne*; Ad Fines, *Broughane*; In Medis; Ad Abum, *Winterton*; Ad Petuarium, Brough; Ad Fines, *Temple Brough on the Don*;—*Tapton Hill near Chesterfield*;—*near Penkridge*; Derventio, *Little Chester*; Ad Trivonam, *Berry farm in Branston*; Brinavis, *Black Ground near Chipping Norton*; Olia Castra, *Alcester, Oxfordshire*; Dorocina, *Dorchester, Oxfordshire*; Tamesis, *on the Thames.*

Besides these, there are other remains of Roman stations, not mentioned in Richard of Cirencester, found at Sandby in Bedfordshire; in Berks, at Lawrence Waltham; Roundabout, near Bagshot; in Bucks at Chipping Wycombe; at Shelford in Cambridgeshire; in Cornwall at Bossens in St. Erth, and near Stratton; in Cumberland at Moresby, Ellenborough, Pap Castle, Old Carlisle, Whitbarrow, Bew Castle, Netherby, Liddle Mount, Castlesteeds in Castle Sowerby, Mawbrugh, Ponsonby, Whitestones, Eskmeal, Cuningarth, Kirkland, Hardknot, and Bainscar; in Derbyshire at Buxton, Brugh, Melendra Castle, Parwick, Chesterfield, Pentrich, in Devon at Countesbury and Hembury Fort; in Dorsetshire at the Isle of Portland, St. Anne's hill, west of Christchurch, Poundbury; in Durham at South Shields, and Chester le Street; in Essex, near Sturmere, at Dunmow, Chesterford, Harwich, and on the Blackwater; in Gloucestershire at Bourton on the water, Dornton, Lydney, near Crosshands and near Dowdeswell; in Hamps at Buckland near Lymington; in Herefordshire at Brandon camp, near Leintwardine; at Newton in Huntingdonshire; in Lancashire at Colne, at Overborough, and near Rochdale; in Leicestershire at Medbourn and Ratby; in Lincolnshire at Ludford and Horncastle; in Norfolk at Taesborough, Caistor, Brancaster, and Castle Acre; in Northamptonshire at Irchester, Wadenhoe, Cottestock, Woodford, and Cotton Mill; in Northumberland at Southwell, and Combs; in Oxfordshire at Stonefield; at Brig Casterton in Rutlandshire; at Chesterton in Shropshire; in Somersetshire at Ilchester, *(Ischalis,)* and near Burrington; in Staffordshire at Rocester; in Suffolk at Ixworth, Icklingham,

Burgh Castle, Creeting, Walton, and near Lawshall; in Sussex at Rowland's Castle, near Pulborough, and near Portslade; in Westmorland, at Watercrook, and Ambleside; in Wiltshire at Woodyates Inn, Wanborough Nythe, and Easton Grey; in Worcestershire at Worcester; in Yorkshire at Addle, Maiden Castle on Stainmore, near Pickering, Whitby, and Askrig. In Wales at Holyhead, Anglesea; near Beaumaris, Anglesea; C. Gai, near Bala, Merionethshire; Penalt, near Machynlleth; Caer Lws, Montgomeryshire; Gaer, near Montgomery; Flint, Caergwrle, Flintshire; Holt, Denbighshire; on the Ythan, Radnorshire; Llanio-isau, Cardiganshire; Llanvair-ar-y-brin, Caermarthenshire; Gaer, near Brecon; Cwm du, Brecknockshire; near Newcastle, Caermarthenshire.

The stations and camps on or near the walls of Antonine and Severus, were at Cousins house, Newcastle, Benwel-hill, Rutchester, Halton Chesters, Walwick Chesters, Carrowbrugh, House-steeds, Little Chester, Great Chester, Caervoron, Burdeswold, Cambeckfort, Watchcross, Stanwick, Burgh, Drumburgh, and Boulness.

See *Hatcher's Richard of Cirencester: Reynold's Itinerary of Antoninus: Whitaker's History of Manchester: Horsley's Britannia Romana: King's Munimenta Antiqua: Roy's Military Antiquities: the Introduction to the Beauties of England and Wales, &c.*

CASTRAMENTATIONS. See *Castra.*

CASTRUM DOLORIS, a lofty tomb of state, in honour of some eminent person, usually erected over his grave in the church where he is interred; decorated with arms, emblems, and, in catholic countries, with lights.

CAT, a peculiar kind of ship, of Norwegian construction, with narrow stern projecting quarters, a deep waist, and ornamented prow; generally built remarkably strong, and carrying from 400 to 600 tons, or, in the language of the mariners, from 20 to 30 *keels* of coals. Cat is also a sort of strong tackle or combination of pulleys, to hook and draw the anchor perpendicularly up to the cat-head.

CATABASION, (from Καταβαινω, Gr. *I descend,*) in the Greek church a place under the altar where the relics are kept.

CATABULUM, a kind of stable for beasts of burden, kept at the public expense. The ancient Christians, were sometimes condemned to labour in the Catabula.

CATACAUSTIC CURVE. See CAUSTIC CURVE.

CATACOMBS. (From Κατακοιμαω, Gr., *I sleep out*, or *away*, or from Κατα and κυμβος, Gr. *a hollow, or cavity.*) Subterraneous places for burying the dead; named also *hypogeum, crypta*, and *cæmenterium fornix, subterranea, &c.* Catacombs for burying the dead have been used by various nations; those of Egypt are believed to be the most ancient; of these, travellers describe five distinct series; those of Alexandria, Saccâra, Silsilis, Gournou, and the tombs of the kings of ancient Thebes.

The Egyptian catacombs are about nine leagues from Grand Cairo, and two miles from Zaccara; they extend over a country covered with fine sand, to the pyramids of Pharaoh, a distance of 8 miles. The entrances to these tombs are closed and covered over with sand; many have been opened, but a greater number yet remain concealed. The embalmed bodies found in these tombs are called mummies, supposed from the Arabic *mum*, wax; this substance being used in the process of embalming. A white free-stone is found under the sand, in the whole extent of the district of the Egyptian catacombs, in which excavations have been made for the reception of the embalmed bodies; these are entered by square openings of about 18 feet deep; are sometimes 40 feet below the surface, and called *wells*; from the bottom of these, passages 10 or 15 feet wide open into chambers of 15 or 20 feet square. Each catacomb contains several of these apartments communicating with each other, the series under ground are very extensive, and reach under the whole extent of the city of Memphis, and into its surrounding vicinity. The walls of some of the apartments are covered with hieroglyphic characters; others contain nothing but mummies, in tombs hollowed out of the surrounding walls. The Egyptians excelled all other nations in the art of embalming, and the bodies found in the sepulchral caves of their country are in a more perfect state of preservation than those of any other.

The catacombs of Italy are very extensive, those of Naples and Rome having been formed by the appropriation of the excavations of quarries, which have been formed into suits of apartments and narrow galleries; some of these are 80 feet below the surface, and from 8 to 19 feet high; the narrow alley or gallery not more than 3 feet broad. The dead bodies are laid 3 or 4 rows over each other in mural recesses, closed up with large thick tiles; or with marble, on which the name of the deceased is sometimes engraved; but more commonly the cypher X P. with the figure of a palm. The cypher is understood to be intended for the word *Christ*, denoting the deceased to have been a Christian convert. Symbols of pagan superstition are also frequently found.

At Naples, the catacombs are nobler and more spacious, than those of Rome: in these are found marble monuments, with inscriptions in Greek and Latin.

The Syracusan catacombs are the largest, and in the most perfect state, of any yet discovered; their appearance is less gloomy, and in the ornaments in different parts, referrble to the latter period of the Roman empire; these consist of Greek paintings, with symbolical representations of the martyrs, placed within many of the tombs. In the island of Malta catacombs have been discovered; they are not very extensive, but in an excellent state of preservation.

CATACONUM, the want of height proportionate to the breadth of the chapiter of a pillar.

CATADROME, a machine used by builders to raise and let down great weights.

CATAFALCO, an ornamented scaffold used in funeral solemnities.

CATAGRAPHA, in ancient ornamental workmanship, figures of men's faces represented as viewed obliquely.

CATANIA, an Italian city, not far distant from Mount Etna, remarkable for numerous architectural remains: particularly an elephant of touchstone in the centre of the great square; with an obelisk of Egyptian granite on his back: the ruins of a theatre, a large bath almost entire, an aqueduct eighteen miles long, and several temples, some of which are converted into churches.

CATASTROMA, a scaffold raised upon the head and stern of ancient war-ships; on which the soldiers were posted.

CATCH DRAINS, the feeders of reservoirs. In the constructing of canals, the same as counter-drains.

CATENARIA, (*Catena*, lat. a

chain) a chain, or other heavy flexible body suspended by its two extremities, forms the curve to which this appellation is given; which is considered the best form for the arch of a bridge.

CATERTHUN, or CATTERTHUN, (*Gael. Camptown,*) an ancient military station in Scotland, a few miles N.W. of Brechin, in Angusshire. This fortress, or rather camp, is supposed of Pictish or Danish origin, though afterwards used by the Caledonians. It consists of an immense quantity of loose stones ranged in an elliptic form: a ravine is also strongly marked round the summit. The size of some, and the immense mass of the whole of these stones, the height to which they have been raised, and the distance from which they must have been brought, with the rude outlines of birds, beasts, &c. which appear on some of them, have much perplexed antiquarians. Mr. Pennant is of opinion that this place was occupied by the Caledonians previous to their engagement with Agricola. The stupendous dike encircling this enclosure extends 122 feet from the base within to that without: a deep ditch surrounds the base, and, 100 yards below, another ditch has encompassed the hill. The internal area is flat; the axis, or length, 436 feet; the transverse diameter of the centre 200 feet. Near the east side is the foundation of a rectangular building; and numerous others appear in various parts, some circular and others very small, which had once their superstructures, to shelter the possessors of this post. A hollow place, filled with stones, marks the place of the well. Brown Catterthun is a smaller fortification of the same kind, on a hill, the earth of which is of a brown colour.

CATHARINE WHEEL, in ancient buildings, is an ornamented window, or compartment of a window, of a circular form, with rosettes, or radiating divisions, of various colours. In the cathedral of Rheims, the great church of St. Oüen at Rouen, in Winchester cathedral, the church at Cheltenham, and in each of the transepts of St. Peter's at Westminster, are fine specimens of ornaments of this description.

CATHEDRAL, (Καθεδρα, Gr.) the head church of a diocese, sometimes called *ecclesia matrix*, or mother church. In England, Germany, and other parts of Europe, the most perfect remains of ancient Gothic, Saxon, and Norman architecture are found in the cathedral churches. There are generally in buildings of this denomination a nave, two side aisles, and north and south transepts. The cross of the transepts is half the length of the whole building; each of the aisles is one-fourth of the breadth and height of the nave; the height of the building is generally equal to the breadth of the nave and aisles; and the elevation of the tower and spires is in a mean proportion between the length of the nave, and of the transept. Exceptions to these general proportions are uncommon; yet in the church of St. Peter at Westminster, and the collegiate church at Bristol, the side-aisles extend beyond the transepts. See *Church*.

CATHETUS, a perpendicular line, passing through a cylindrical body, as a baluster, or column. It is also a line falling perpendicularly, and passing through the centre, or eye, of the volute of the Ionic chapiter.

CATTLE-SHED, see *Bullock-shed* and *Feeding-House*.

CATTUS, a moveable shed, usually fixed on wheels.

Cavædium, in ancient buildings, an open court, of which five sorts are described, the Tuscan, with a projection over-head, from each wall, leaving the middle open. The Corinthian, with a similarly projecting roof, supported by columns. The Tetrastyle, with columns at each of the four corners. The Displuvinated, without any projecting roof, and the Testudinated, with a vaulted covering from wall to wall. This last is improperly called a Cavædium or court.

Cavazion, or **Cavasion**, the foundation plan for the walls of a building, which may be as deep as one-sixth part of its height.

Cave, (*Cavum*, Lat.) One of the oldest species of architecture of which we have any remains, are the excavations in rocks, &c. They were, without doubt, intended for religious worship, and not for dwelling places. They have originally been formed by very ancient races of people, and universally carry with them, wherever any popular traditions connected with them are preserved, ideas of superstitious fear and veneration. Caves of this description are frequent in Great Britain and Ireland, and sometimes preserve evident marks of their destination. Some very deep and extensive caverns are found in the Isle of Thanet. One, discovered in 1780, consisted of seven large rooms, from twelve to thirty-six feet wide, communicating with each other by arched avenues. Some of them have large conical domes, 36 feet high, and supported by a column of chalk 43 yards in circumference. The descent is by a flight of steps. The sides and roof are rocks of chalk; the bottom is a fine dry sand, and 170 feet under ground is a well of very pure water, 27 feet deep. This well might be used for the lustrations and purifications by water which were prescribed to the initiated. That these caves were hollowed for refuge from the attack of an enemy, is very improbable. They have been a work of greater labour and industry, than would be employed by people under the confusion and terror that such an event would excite. The Druids, like the worshippers of Mithra, performed their mysterious rites in caves.

There is a remarkable cave in Cornwall, called Pendeen Vau, by the Welsh pronounced Fau: it consists of three caves or galleries, walled on each side with large stones, and rudely arched at the top. Six steps are descended at the entrance, the floor dipping NNE.; this first cave is full six feet high, and the floor 28 feet long; the second cave, to the right as we proceed, differs from the first in being only five feet six inches in height, and in having in its centre a round pit three feet in diameter, and two deep; at the end of this cave, near the roof, there is a square passage or hole, two feet wide, and two feet six inches high, leading to a third cave, six feet wide and six feet high, dug out of the earth, the sides and roof of earth, straight on the sides; the roof semicircular: this cave also ends in a semicircle, the length 26 feet six inches. See Borlase's *Antiquities of Cornwall.*

There is a singular cave at Royston, on the extreme border of Hertfordshire, joining Cambridgeshire; it is immediately beneath the Market-place, and dug out of the solid chalk rock; its entrance was a perpendicular aperture of a circular form, two feet in diameter, closed by a millstone when it was first discovered in 1742; from this opening, steps were cut in the chalk on each side, to facilitate the descent to the bottom. When the rubbish was cleared away, a scull and other human bones were found much decayed; round the side were rude carvings of the Crucifixion, St. Christopher, St. Catherine, St. Lawrence, and various other legends. A seat one foot high surrounds the bottom, except a division at a hollow place in the floor, called the grave. This cave or crypt is conjectured to have been an oratory and burial-chapel of the pious lady Roisia, but so uncertain are the traditions relating to this affair, that it gave occasion to a long-continued controversy between Dr. Stukely and the Rev. C. Parkin, without conviction on either side. The respective pamphlets are worthy of perusal, containing abundance of curious and interesting matter. The diameter of this circular crypt is about 25 feet; its height between 30 and 40. Mr. King thinks, from its form, that this crypt was originally British.

The ancient caves of Ireland bear undoubted proofs of their former use, and present many remains of symbols connected with the worship peculiar to Mithra. "The genius of antiquity," says Maurice, "delighted in mystery, which was exhibited in their residence in gloomy vaults and subterranean caverns, and woody recesses, their theology veiled in allegory and hieroglyphics." The cave of Mithra, an expressive emblem of the various elements of nature, represented, as we learn from Porphyry, (de Antro Nymphum) the world. From the similarity of the caves in Ireland to those of India, it may reasonably be believed that they were for the same purpose—and the *Deasol*, or circular dance of the Irish, is no other than the Pyhrric dance of the East. Ou the north side of the left-hand niche of the Mithratic cave of New Grange in Ireland, is an ancient inscription in characters from two to six inches high. These characters are dissimilar to any thing of Northern origin, Punic, Saxon, or Irish, and are believed to be Phœnician. By comparing these characters with numerous Phœnician alphabets, the word appears to be Mithrak, the Chaldean name of Mithra. There is another Mithratic cave or cavern in Ireland, on the glebe of Annagh-clog-mullen, in the parish of Killeavy, county of Armagh; it is of stones, and measures sixty feet in length, and twelve in height. The building consists of four apartments—the first eight feet wide, and nine feet six inches long—the second six feet six inches wide, and six feet eight inches long—the fourth, two feet wide and six feet long. In front is a semicircular porch of rude stones, 33 feet in diameter; at eight feet distance from this entrance are two pillars or phalli, nine feet high. The chambers are arched with dry corbelling stones, as at New Grange, the top covered with a flag, three feet broad:—the arch springs three feet from the ground. See Col. Vallancy's *Collectanea de Rebus Hibern.*

The most ancient inhabitants of Greece undoubtedly performed their religious rites in caverns, and they were often adopted by succeeding generations as the site of their temples, of which they formed the most sacred part. And hence even in after-times the innermost part of the temple was denominated *the Cavern.* One of the most remarkable caverns in Greece was that of Trophonius. See *Adytum.* Near Nauplia in Argolis, there were caverns, which, according to Strabo, were called Cyclopean. In Persia and India, caves continued in after ages to be held in the same veneration, and were ornamented internally with a profusion of architectural ornaments and emblematical sculpture. See *Ellora* and *Elephanta*.

Subterraneous pits and caverns, undoubtedly of British construction, are found near Guilford, in Surrey, near Crayford in Kent, and many other places. They are often descended into by means of a pit or well, and are sometimes entered on a level through the side of a hill. Within they are of different magnitude and description, some having only one spacious apartment, but they are generally divided into several rooms. Diodorus Siculus expressly tells us, that the Britons did lay up their corn in *subterraneun repositories*, and some of them may have been used for that purpose.

Cavea, the dens or caves, in ancient amphitheatres, in which wild beasts were kept; by some authors applied to the central part of these buildings, usually called the *arena*.

Cavetto, (diminutive of *cavus*, lat.) a concave ornamental moulding, opposed, in effect, to the ovolo; the concavity of the one, and the convexity of the other, are not allowed to exceed the quarter of a circle. In its projection, the cavetto is equal to its altitude, and not allowed to be less than two-thirds of it. It is applied to the bases of pedestals, and the mouldings of cornices, and in some of the most beautiful Ionic architraves it forms the upper member.

Caulicoles, slender stems or stalks under the leaves of the abacus, in the Corinthian capital. Between each pair of the uppermost leaves, eight stalks branch out into two leaflets, seeming to support the sixteen volutes, of which four are on each face of the abacus.

Caulking, is the operation of filling up the seams of planks, on the sides or bottoms of ships, with untwisted ropes and pitch, to which the name of oakum is given. After this operation is completed, appropriate iron implements called caulking irons, are used, to cover the work with a mixture of pitch, tar, and tallow, as low as the ship draws water.

Caulking or **Cocking**, the old mode of fixing the binding joists of a floor, or the tie-beams of a roof, was by dove-tailing into the wall-plates.

Causeway, or **Causey**, (*Chaussée*, Fr.) a raised or paved way. A famous ancient work of this description extends over the county of Northumberland; supposed to be Roman, but suspected of later date by Mr. Horsley. It is called the Devil's Causeway.

Caustic Curve, formed by the collected rays of light, issuing from a curved reflector. Called also, the catacaustic curve.

Cecropium, the ancient name of Athens, derived from Cecrops its founder.

Cedar, (Κεδρος, Gr.) the Pinus Cedrus of Linnæus; by Tournefort ranked under larix; it is a coniferous evergreen, bearing large roundish cones of smooth scales, standing erect; the leaves small, narrow, and thickly set. This tree is no where found native, but on Mount Libanus; and it is distinguished by the appellation of the *cedar of Lebanon*, by the ancients called *cedrus magna*, or the great cedar. The timber of this tree is sometimes used in building: it is reputed to be almost immortal and incorruptible. Solomon's temple, as well as his palace, were of this wood; and king Hiram had several cities given in exchange for the cedars furnished on these occasions. Certes is said to have erected a palace at Mexico which contained 7000 beams of cedar, most of them 120 feet long, and 12 in circumference, as related by Herrara. A cedar was used for the main-mast of a ship belonging to king Demetrius, which measured 130 feet long, and and 18 in diameter. In the temple of Apollo at Utica, there are cedar trees nearly 2000 years old; and at Seguntium in Spain, in an oratory of Diana, there is a beam of cedar, said to have been conveyed there 200 years before the destruction of Troy. Pins of the same wood are preferred to iron for fastening planks, on account of its extreme dryness.

Ceiling, (From *cœlum*, the sky) the inner roof of a building; or the lath-and-plaster covering of the top of a room: in the former instance the term is applicable to roofs of temples and churches, which admit of various and splendid ornaments. Coved ceilings are more expensive and beautiful than flat ones; but historical and other paintings are often introduced with good effect in the centre of flat ceilings, or in their angular compartments. Ceilings are frequently adorned with compartments, raised; or the pannels are depressed within mouldings; their figures various, circular, elliptical, &c. These compartments are decorated with roses, foliage, and other ornaments. The figures of the coves of ceilings are usually the quadrant of a circle, or of an ellipsis, taking its rise a little above the cornice, and finishing at the border, round the great pannel in the centre. The border projects a little beyond the coves on the outside; and a space is left in the side toward the pannel, to admit the ornaments of an architrave. The compartments of the ceilings of ancient Temples and their Porticos, were generally in equilateral forms, which generate squares in the surrounding spaces; but the junction of polygonal pannels, afterwards introduced, varied these forms. The junction of hexagons produces lozenges or triangles; of octagons, squares and octagonal spaces; this mode of ornamenting is termed *coffering;* and the parts recessed are called *coffers*. The method of ornamenting vaulted roofs with coffers, and encirclements of belts, charged with foliage or frets, is derived from the ancients; as may be seen in the remains of the temple of Balbec, the temple of Peace at Rome, and various ancient ruins. A roof is said to be *camp* or *tent* ceiled, which has the ceiling under the rafters. See the articles *Vault*, *Soffit*, *Intrados*.

Cella, (Lat.) the sanctuary or interior part of a temple, which was called by the Greeks, *ναος*, *δομος*, *σηκος*. The porticos which precede it were called *pronaos*, and *prodomos*. Behind it was often a chamber, to contain the treasure of the temple, which was called *opisthodomus*, that is, the hinder part of the cella. The cella was exactly half as wide as long; the width was divided into four equal parts, the length into eight. Eight were occupied by that to which the term cella was properly applied, comprising the wall which contained the entrances, and separated the pronaos. The three other parts from this wall to the centre formed the pronaos. The antæ had always the same proportions as the columns of the portico. When the cella was not sufficiently wide, the entablature was supported by the antæ alone, and the space between them was left open, as in the temple on the Ilissus at Athens. Two columns were placed between the antæ, when the cella was more than twenty feet wide, as in the temple of Theseus at Athens, and the temple of Minerva at Sunium. Balustrades, with doors to enter the pronaos, enclosed the intercolumniations between the columns and antæ. Other columns were placed in the interior of the pronaos, opposite the columns that were between the antæ, when the cella was more than forty feet wide. These are the general rules given by Vitruvius, but they do not agree with all the ancient temples of which remains are left. A different distribution is sometimes given to the hypæthros. The upper part of the cella of the hypæthros was not covered, its length was more than double its width; and as each façade had an entrance, there were both a pronaos and a porticus. Pausanias mentions a temple which had no entrance at all, that of Jupiter Lycæus, in the public square of Megalopolis, the capital of Arcadia. But this temple was probably very small, and was rather a species of monument than a regular villa. The altars, &c. appear to have been arranged at the sides and front, and the temple and consecrated place were surrounded by a dwarf wall, or peribolos. An interior portico, consisting of two ranges of columns placed one above the other was often continued all round, to cover a part of the cella of the hypæthros. It had two stories or galleries, one forming a covered place in the cella, the highest serving to reach the upper part of the statue of the divinity that was placed in the temple. The temple of Jupiter Olympius, and apparently also the great temple of Pæstum, contained such galleries. On this architrave, which the lower columns supported, large stones, which united the walls to the cella, formed the ceiling of the lower and the flooring of the upper gallery.

Each temple had in general but one cella, except one kind of Tuscan temple, which had three, one on each side of the other. The cella of the Greek temples were, in some instances, separated into several divisions, but they were always behind one another. Temples at Sicyon, near Argos, on the road to Mantinea; at Mantinea; the temple of Ilithyia, in the sacred wood of Altias at Olympia; and the Erechtheium at Athens, had double cellæ of this kind. Pausanias describes a singular temple at Sparta, which had two cellæ, one below the other; in each there was a statue of Venus, and that of the upper cella bore the surname of Morpho. The cella was almost always built of large stones, in the manner called *isidomum*: this pavement was always raised higher than that of the portico, with steps at the entrance; the exterior sides were very simple, and had scarcely any ornament; the four corners were the antæ, which were evidently first built for strength as counterforts. The wall between these antæ was without ornament; a base only was added to the lower part: this upper part was ornamented with several members, or with an entablature like that of the portico: the frieze was not so high. The cella, and also the frieze, in some temples, was ornamented with bassi relievi. In the interior of the cella was placed the statue of the god to whom the temple was dedicated: it was always raised upon a base, against the rear wall, opposite the entrance. In the hypæthros it was placed near the door of the rear front, where the galleries and porticos of the interior joined, and formed a canopy over the statue: a veil, or curtain, was placed before it when they were not sacrificing.

The word *Cella* was often used

by the Romans for the names of apartments in their baths, such as *cella calidaria*, *cella frigidaria*, *&c.*

Cellar, (*Cella*, Lat.) a place under ground, where stores and liquors are deposited. Cellars, in modern buildings, the lowest rooms of a house, the ceilings of which are usually level with the surface of the ground; or they are under the pavement before the house. These apartments requiring to be kept cool, have usually double walls, with a passage between them, and sometimes a vaulted roof.

Celtic Architecture. The denomination of Celtæ includes the original inhabitants of Britain, Gaul, and Iberia, or Spain. From the circumscribed knowledge which we possess of their mode of life, it is difficult to ascertain the exact progress which they had made in architecture; but their efforts in building were doubtless very rude and undurable. In the British towns there were no buildings that were calculated for the eye of posterity. According to Cæsar, they consisted only of mean huts and cattle-sheds, in the midst of a thick wood, and fortified by a high bank and a ditch. These latter were, however, calculated for longer duration, and many of them still remain as testimonies of former population. At *Ambresbury Banks*, near Copped Hall, in Essex, there is a remarkable specimen. "This intrenchment was formerly in the very heart of the forest, and is of an irregular figure, rather longest from east to west, and on a gentle declivity to the south-east. It contains near twelve acres, and is surrounded by a ditch and high bank, much worn down by time; though, where there are angles, they are still very bold and high. There are no regular openings, like gateways or entrances."—(*Gough's Camden.*) This description of a town, however, was peculiar to the inhabitants of the lowlands. In the more mountainous districts, in several parts of Wales, and in Cornwall, in Lancashire, Shropshire, Cambridgeshire, Herefordshire, &c. the traces of these fastnesses, or towns of retreat, are found on the summits of all precipitous hills. They generally inclose a considerable area, and their form is guided by the natural shape of the hill they occupy. When the sides are not defended by precipices, they are guarded by several ditches, and by ramparts of earth or stones. They have generally two entrances. The *Herefordshire Beacon*, on the summit of one of the highest of the Malvern hills, is without doubt the remains of an ancient British town. Its height is 1444 feet above the level of the sea. The area of the Castramentation comprises an irregular oblong, of 175 feet by 110 feet, and is surrounded by a steep and lofty vallum of stones and earth, and by a deep ditch on the outside. Attached to the principal area are two outworks, of considerable extent, situated lower on the sides of the hill. Each of these encloses a plain, probably intended for the reception of cattle, and both are artificially connected by a narrow slip of land, secured by a bank and ditch. The acclivity of the hill, in its approach towards the summit, is guarded by several rude, but formidable banks and ditches.

Within the area of many of these encampments, are remains of the foundations of numerous cells, or places of habitation, which are generally circular or oval, the usual form of the dwellings of the Britons. Many of these remains are found in Cornwall, and vestiges of habitations, supposed to be British, occur in several recluse parts of England

and Wales. Many of them are discovered on Dartmoor in Devonshire. See *Polwhele's History of Devon.*

Cement. Various compositions of this denomination belong more particularly to the joiner; others, of a different description, are used by the plasterer; and the class of cements purely calcareous, belong exclusively to the mason.

Glue is made from the sinews and skins of animals; that from the skins being in all cases preferable, and the glue made from land animals being less affected by the moisture of the atmosphere, is generally to be preferred, even to the best isinglass. Good glue is generally very transparent, and will swell, but not dissolve in cold water. Also the best glue, when dissolved by heat, will draw out in long threads.

A cement for making up holes and flaws in wainscots, and for other purposes, is made by mixing equal parts of pounded resin and bees' wax, and adding to this solution, as it melts over a slow fire, chalk, yellow ochre, or burnt ochre, as much of each as will produce the colour intended. Or for the same purpose, take fine sawdust of the wood you wish to imitate; macerate this in water two or three days, then pour off a part of the water, and boil the residue till it becomes smooth and pulpy. Keep this covered up for use. When used, mix as much glue with it as the occasion may require. For fixing fillets and mouldings, carved ornaments, and other similar purposes, a very strong glue or cement is made by dissolving isinglass, and adding glue to it which has soaked twenty-four hours, and straining the whole through a coarse cloth. See *Mortar* and *Stucco.*

Cemeteries, places where the bodies of the dead are deposited; which were not allowed to be buried in churches, or within cities, in ancient times; but were ordered by law to be without the walls: yet they were held sacred, and frequently resorted to; and according to Eusebius and Tertullian, the early Christians had their assemblies in the cemeteries, and afterwards, in the time of Constantine, erected churches in them, as places rendered sacred by containing the mouldering remains of the martyrs: and hence the Catholic rule, which is yet retained in the Roman church, never to consecrate an altar without placing under it the relics of some saint. The practice of consecrating cemeteries has the same origin.

Among the Turks it is the universal custom to place cemeteries on the outside of their towns, and in the vicinity of Smyrna, and various other places, in these receptacles of the dead, abundance of cypress trees, rosemary, and other odoriferous shrubs and trees, are planted, which exhale a pleasant and salubrious fragrance: this is not only a very suitable mode of ornamenting burial grounds, but is a successful method of purifying the air.

The *Campo-santo* of Pisa was begun by Archbishop Ubalno, in 1200: the celebrated John of Pisa was the architect; and it yet remains one of the most remarkable and interesting monuments of antiquity to be found in Europe: it is one of the first in which the classical style of architecture was revived. Its length is four hundred and ninety feet; its breadth, one hundred and seventy; and its height sixty: its form rectangular. The southern front is ornamented by forty-four pilasters, supporting arches. Where the arches unite, at the top of each capital, is a mask, of a form suited to the capitals, which retain the whimsical and unclassical style of those times. This edifice is of white marble from the mountains of Pisa, the whole squared and jointed with great accuracy. The interior, which is entered by two side-doors, is a vast court of four hundred and sixty feet in length, around which is an arcade of sixty-two demi-gothic arches, supported by columns, to which a surbase is the only pedestal. Numerous paintings of the early masters ornament the galleries, which are paved with the finest marble. Antique sarcophagi, raised on consoles, and placed on a surbase, ornament the porticos, under which the monuments of celebrated men of Pisa are yet to be seen. Queen Christina of Sweden, called this cemetery "*Non un cimeterio ma un museo;*" and it was here that the king of Prussia placed the monument of the celebrated Algarotti, and inscribed upon it—"*Algarottus non omnis.*"

Cenotaph, (*κενοταφος*, Gr.) an honorary tomb or monument, distinguished from other monuments in being empty, the individual it is to memorize having received interment and funeral honours in some distant land, or having perished at sea: these latter are commonly distinguished by the figure of a ship, or the representation of a wreck at sea.

Centaur, a poetical imaginary being of heathen mythology, half man and half horse. The Centaurs were in reality a tribe of Lapithæ, inhabiting the city of Pelethronium: these people are said to have been the first who tamed and managed horses, from which circumstance the fable originated.

Centering, in building. The same used in turning an arch of stone or brick. See *Carpentry.* The centering of a large vault is formed with trusses or ribs, at equal distances from each other in vertical parallel planes, boarded over so as to coincide with the intended shape of the arch. The distance of the trusses from each other should be regulated by the strength of the boarding, and the weight of the arch; on very large works a truss is laid for every course of arch stones. In rivers that are not navigable, the construction of the truss is very easy, as it may be made with a beam from the bottom. If the river be navigable, it requires much greater skill, an opening being required for vessels to pass through. Instead of the horizontal tie, a number of ties must be disposed around the polygon, which forms the interior part of the centre; and great attention must be paid to the variation of the pressure on the various parts, as the work proceeds. The pieces which support the arch from the several pressing points, must be made to act in the direction of their lengths. If the timbers are drawn in the direction of their length, the joints should be strapped; but the abutting joints will be sufficiently resisted when pressed, if the shoulders be perpendicular to the direction of their force. All the openings of a truss should be triangles, and the intersection of the timber should be as little oblique as possible. The centering of an arch may consist either of one centre around the interior of the entire arch, supported between the piers; or the aperture may be subdivided by supporters, each consisting of posts of wood braced together. The bridge of Orleans, by M. Husseau, is one of the boldest centres ever executed in Europe. It was constructed by means of a large truss, spanning the whole opening; its vertex supporting the summit of the arch, and its rafters supporting subordinate trusses, which resisted the pressure of the arch at other intermediate points.

The centering of the nave and transepts of St. Peter's at Rome, by Michael Angelo, and two centres by Pitot, were formed on the principle of two independent trusses, one supporting the sides or haunches of the arch, and the other the crown. The centering of the bridges of Cravant, Nogent, Mayence, and Neuilly, were constructed by Perronet, on the principle of inscribed polygons; the exterior beams, supporting the curve, were of equal lengths, and joined together in the form of a polygon: within this, another polygon was formed, with its angles in the middle of the sides of the former, and so on alternately; until as many polygons were inscribed as would make the centerings sufficiently strong. The centering of the Westminster and Blackfriars' Bridges in London, was constructed on a still different principle. It consisted of a series of trusses, each supporting a point in the arch, the principal braces having their lower extremities abutting below, at each end of the centering on the striking plates, and at the upper end upon apron pieces, bolted to the curve which supports bridgings for binding the pieces which compose them together at their junction. Another mode of centering is by a number of quadrilateral frames abutting on each other, having their joints radiated to a centre, like the wedge-stones of an arch. These frames should be strengthened by one or two diagonals, according to the kind of strain, and must be secured by keys or bolts.

In the figures given in Plate Carpentry, C 9, *Fig.* 1. is the manner of constructing a centre with four polygons, independent of each other, as used by Perronet. *Fig.* 2. is the construction of a frame by separate frames, the sides of which radiate to a centre. *Fig.* 3. is the celebrated centre used at Blackfriars' Bridge. A diagram of the centering of Waterloo Bridge is given in Plate B. 18. under the article *Bridge*.

Centre, (Κεντρον, Gr. *Centrum*, Lat.) in Geometry, a point in a figure or solid, by which any straight line passing through it to each of the sides will be equally bisected.

Centres of a Door, the two pivots round which the door revolves.

Ceramicus, (Κεραμιχος, Gr.) the name given to that part of the city of Athens which was S.W. from the Acropolis, so denominated, according to Pausanias, from Ceramus, the son of Bacchus and Ariadne.

Ceroma, (Κερομα, Gr.) in the gymnasia, and in the baths of the Romans, an apartment where the bathers and wrestlers were anointed, as the name imports, with oil thickened with wax.

Ceroplastic, the art of modelling in wax. The Romans placed busts of their ancestors, made of wax, in the vestibules of their palaces, and carried them in procession, on solemn occasions, and at funerals.

Cesspool, see *Sesspool.*

Cestophorus, sculptures of females bearing the cestus, or marriage girdles, in the marriage ceremonies of the ancients.

Chain-Timber, a piece of timber, in breadth equal to the length and breadth of a brick, used for strengthening brick walls, by inserting in the middle of the height of the story.

Chair, Curule, the honorary seat, from which the chief public officers of Rome took their denomination of *Curules*; it was generally of ivory, or other costly materials, and highly ornamented; not only used as honouring dictators, prætors, censors, and ediles, but also the pontiffs and vestal virgins claimed their use. This honorary vehicle is often seen represented on Etruscan monuments, and from this people the custom is believed to have been originally derived to the Romans.

Chalcidicum, a large and magnificent apartment, belonging to a court of justice. It is said to have derived its name from Chalcidicus, a city of Eubœa.

Chalciœcus, a magnificent temple of Minerva, built of brass.

Chalk, (*Ceta*, Lat. *calck*, Sax.) a well-known white substance, found in abundance in Great Britain, and in most parts of the world. It is a carbonate of lime, insoluble in water, but decomposed by heat, and used in masonry for the same purposes as lime-stone. see *Cement.*

Chamanim, (from *Chaman*, Heb. *to burn*,) idols exposed to the sun on the tops of houses; by the Greeks called *Pireia.* Aben Ezra says they were portable chariots, in honour of the sun. See *Pireia.*

Chamber, an upper apartment of a dwelling-house, a term derived from the Greek *καμαρα*, a vault, the word originally signifying a vaulted room. With the exception of the term *presence chamber*, this word is synonymous with bed-room; with the French it has a more extensive meaning, as *chambre à coucher*, *chambre de parade*, &c. Bed-rooms are frequently finished in a highly ornamental style, with a spacious niche or alcove, for the bed. The upper story is generally divided into inferior bed-rooms. See *Alcove.*

Chambers, Sir William, surveyor-general of the board of works, fellow of the royal and antiquarian societies, treasurer of the royal academy, and knight of the polar star in Sweden, was descended from an ancient Scottish family; his ancestors were barons of Tartas in France. His grandfather, suffered great loss, by supplying Charles the Twelfth of Sweden with large sums of money, which his father attempted to recover, residing in Sweden for that purpose. Sir William was born in that country, and at the age of eighteen was appointed supercargo to the Swedish East India company. He some time afterwards made a voyage to China, and finally settled in England. He was patronized by lord Bute, and, through his interest, employed in decorating Kew Gardens with Asiatic buildings, temples, pagodas, &c. He rose to eminence as an architect, under royal patronage: and was employed in all the great buildings of the time. His most celebrated works are his staircases, particularly those at Lord Besborough's, Lord Gower's, and the Royal Antiquarian Society's rooms. Great praise has been bestowed on his architectural works at Somerset House, which established his fame as an architect. He published, in 1757, "Designs for Chinese Buildings, Furniture, Dresses, Machines, and Utensils; engraved from the originals drawn in China.—Plans, Elevations, Sections, and Perspective Views of the Gardens and Buildings at Kew in Surrey, the seat of her Royal Highness the Princess of Wales;" a very splendid work, was published in 1765. His dissertations on Oriental Gardeping in 1774. His Treatise on Civil Architecture is a work of great excellence. He died in the year 1796.

Chambranle, an ornamental bordering on the sides and tops of doors, windows, and fire-places: this ornament is generally taken from the architrave of the order of the building: in window frames, the sill is also ornamented, forming a fourth side. The top of a three-sided chambranle is called the *transverse*, and the sides *ascendants*.

Chamfer, or **Champher**, to channel, or make indentures in stones, pillars, or other ornamented parts of a building.

Champain Line, in ornamental carved work formed of excavations, is the line parallel to the continuous line, either ascending or descending.

Chancel, that part of a church, at the eastern end, in which the altar or communion table is placed; usually separated from the nave and transept by *cancelli* or lattice-work, from which it takes its name: the name also of a separate division of ancient Basilicæ, latticed off to separate the judges and council from the spectators.

Chancery, or **Chancellery**, the residental palace of the Chancellor: it consists of splendid and spacious apartments, — audience chambers, and council rooms. One of the most admired works of Bramante, is the chancellery at Rome.

Chandelier, a large branched candlestick, suspended in the central parts of halls, and spacious apartments, ornamental, and to give light.

Chandeliers, are wooden parapets, made of two upright stakes, about six feet high, supporting planks laid across one another, used in fortifications, to defend workmen from the attacks of the besiegers.

Chandry, in palaces, a store room for the reception of candles, torches, and other lights.

Channel, a part in the Ionic capital, somewhat hollow, under the abacus, after the listel; it lies upon the echinus, having its contours, or turnings, upon each, to make the volutes. See *Canal of the Volute*.

Channel of the Larmier, see *Canal of the Larmier*: and *Beak*.

Channel Stones, are stones prepared for gutters, or channels, to carry off the water.

Chantry, or **Chauntry**, a little chapel in ancient churches, with an endowment for one or more priests to say mass, for the release of souls out of purgatory. In the 14th year of Edward the Sixth, all the chantries in England were dissolved; at which period there were no less than forty-seven of them belonging to St. Paul's cathedral.

Chapel, (*Capella*, Lat.) a place for public worship, separate from, or attached to, a church: or this term is sometimes applied to a species of mausoleum raised to the memory of persons of celebrity. In ancient edifices the term was properly applicable to those apartments called *Exedræ*, which were detached from the body of the building for retirement or conversation: these were commonly provided in the gymnasiæ, the baths, and the temples. The Pantheon at Rome had seven chapels, or exedræ within the circumference of its walls; these, and the exedræ of the temple of Balbec, are distinguished by the peculiar elegance of their architectural decorations. Our most ancient ecclesiastic edifices have a recess generally of a semicircular form called a *chapel*, as well as smaller recesses named *shrines* or *niches*. The Roman Basilica have also recesses of a similar form, under the same denomination.

CHAPITER (Fr. *Capitello*, Ital.) See *Capital*.

CHAPITERS WITH MOULDINGS, are the capitals of the Tuscan and Doric orders, which are without foliage or other ornamental embellishment,

CHAPITERS WITH SCULPTURES are the Corinthian, and those decorated with foliage and other carvings.

CHAPLET, an ornamental fillet in the form of a string of beads.

CHAPTER HOUSE, the place where canonical meetings are held, usually attached to a cathedral church, and sufficiently capacious to contain all the clergy belonging to the diocese: the ecelesiastical court of St. Paul's is a superior specimen of this kind of building.

CHAPTREL. See *Impost*

CHARGED, implies that one member of a piece of architecture is sustained by another. A frieze is said to be charged with the ornament by which it is covered.

CHARNEL HOUSE, a place where the bones of the dead are deposited.

CHARTOPHYLACIUM, a recess, or apartment, for the preservation of records, or valuable writings.

CHASE MORTISE, the mode of inserting, or mortising, inclined transverse joists into parallel timbers, in ceilings.

CHAUNTRY. See *Chantry*.

CHECKERED. See *Chequers*.

CHEEKS, two equal and similar parts of any piece of timber-work.

CHEESE-ROOM, an apartment in the dairy, in which the cheeses are kept: the walls are supplied with shelves, and the rooms above and below communicate by trap-doors, for the admission of a current of air.

CHEMISE, in fortification, a wall built before a bastion or other bulwark of earth. Also applied to the wall extending from the talus to the stone row.

CHENISCUS, (from χην, a goose,) an ornament in form of a goose, on the prows and sterns of ancient ships.

CHEQUERS, in the facings of walls, are stones of uniformly equal dimensions, so arranged that no interruption occurs in the joints, either horizontally or vertically. See *Masonry* and *Reticulated*.

CHERUB, an ornament introduced by the Italian artists, of an infant's head joined to two wings, used, in ecclesiastical edifices, on keystones of arches.

CHESNUT, or CHESTNUT TREE, (*Fagus Castanea*, *Lin.*) flourishes in a dry soil, has a large upright trunk, usually rising 40 or 50 feet, with a fine spreading head. It sometimes attains an immense size: the largest known are in Sicily on Mount Ætna, which measure from 76 to 150 feet in circumference. The *great chesnut tree of Tortworth*, in Gloucestershire, is 52 feet in circumference, and believed to be 1000 years old. The timber of the chesnut tree is preferable to elm; for door jambs, window-frames, and some other purposes, it nearly equals oak; but there is a deceitful brittleness in it, which renders it unsafe for beams.

CHEST. See *Caisson*.

CHEVAUX DE FRIEZE, Fr. (in fortification,) the Friezeland horse, a piece of timber, a foot in diameter and ten feet long, into which are fixed a great number of wooden pins, six feet long, crossing each other with iron pins at their extremities. They are to place in avenues, to oppose the entrance of an enemy.

Chevron, an ornament in Gothic architecture, to which the name of zigzag, (i. e. turning this way and that, like the letter Z.) is also given.

Chiaro-oscuro, as pertaining to the science of architecture, is that particular part of it usually called Sciography; as an art dependent on the laws of perspective, and exemplified in the drawing of the bisection of an edifice, to display the internal conveniences, the number and proportions of the various apartments, and the thickness of the walls.

Chimney, the passage through which the smoke ascends from the fire, in a dwelling house. The form of chimneys is generally square, and their dimensions proportioned to those of the fire-place, from which they are to convey the rarefied air and smoke, rising in successive volumes. In order to prevent chimneys from smoking, they are sometimes built in a circular form, and the sides covered with plaster, made smooth to prevent friction. See *Fire-place*, and *Smoky Chimney*.

Chimney Shaft, a turret rising above the roof, generally in the centre, to receive and conduct away the smoke of all the chimneys belonging to the building.

Chimney Jambs, the sides rising from the top of the grate to the entrance of the chimney, from the back of which the upper part extends forward under the mantle-piece.

Chimney Piece, the ornaments of chimney-pieces consist of architraves, friezes, cornices, columns, pilasters, termini, caryatides, consoles, and every embellishment which the sculptor can invent or appropriate.

Chinese Architecture. The buildings of the Chinese are, like the people, very peculiar, and differ in many respects from those of any nation with whom we are acquainted. Yet nevertheless there is a considerable similitude in some respects between them and those of the people of antiquity. The general form of almost all their compositions tends to that of a pyramid. Like the ancients, they make their columns with diminutions and bases. The entrelas, so common in ancient edifices, are often seen in those of the Chinese. The *ting* of the latter differs little from the *peripteron* of the Greeks. The atrium, and the monopterous and prostyle temples, have a considerable resemblance to some among the Chinese; and the manner in which they construct their walls, is on the same principle with the revinctum and emplecton described by Vitruvius. The pagodas, or temples, of the Chinese are many of them very small, containing but a single apartment. Others, however, are larger, containing courts, with galleries, &c., and *tings*, where the idols are kept. The large pagoda of Honang, in the southern suburb, occupies a great extent of ground, and contains, besides the temples of the idols, apartments for two hundred bonzes, hospitals for many animals, a large kitchen garden, and a burying ground. In plate C. 29 (*fig.* 1.) is given a plan of this pagoda. The first object, on entering, is an extensive court, containing three rows of trees, which lead to an open vestibule *(a)* ascended by a few steps *(b)*. From this we pass to a second vestibule (*e*), containing four colossal sitting figures in stucco. This vestibule opens into another large court, (*d*) surrounded by colonnades *(c)*, and cells for the bonzes *(f)*. The four pavilions *(g)* in this court, on socles, are the temples, and contain two stories, filled with idols. At the four corners of the court are four other pavilions (*h*) where the superior bonzes have their apartments, and under these columns, between the cells, are four halls, (*i*) occupied by idols. On each side of this great court are two other small courts (*k*) surrounded with buildings; one is for the kitchens, (*l*) and for the refectories (*m*), the other serves for the hospitals (*n*). The same plan is observed in all the larger temples, and by detaching from them the three pavilions or temples in the great court, we may form an idea of the manner in which all Chinese edifices of great extent, such as the imperial palace, those of the princes and of the mandarins, the Kong Quaens, are laid out. The bodies of the pavilions are of stone, but the columns which support them, as well as the colonnades, are of wood, with bases of marble. All the buildings are covered with green, varnished, porcelain tiles. The tings, or temples of the idols, differ little in shape, being commonly similar to that given on plate C. 29 (*fig.* 2) which is a copy of the *ting* of the Nagada of Cochin-China, in the eastern suburb. They are all raised on a base, ascended by two or three steps. This is a square, surrounded by a colonnade of twenty columns, which support a roof surrounded by a wooden balustrade, with a gallery surrounding the whole second story, which is of the same figure and dimensions as the first. The corners of the roof are ornamented with sculptured dragons. The proportions of the Chinese buildings are quite irregular. In the *ting* represented in *fig* 2. the breadth of the edifice from the exterior surface of the columns equals the elevation, and the diameter of the body of the building is two-thirds of the breadth. The height of the order is two-thirds of the diameter of the body, and the height of the second story is two-thirds of that of the first. The columns contain in height nine of their diameters, the bases two, and the beams and brackets, which occupy the place of capitals, only one. The figures (1 and 2) on plate C. 28, represent two little buildings of wood, in the courts of one of the pagodas of the western suburb. They are two pavilions, that cover two iron vases, which are used for the sacrifice of gilt paper to the idols on festival days. They are both octagons, supported by eight columns, which have bases differing little from the attic. A frieze charged with inscriptions in Chinese characters, surrounds the space between the columns under the roof.

Of the towers called *Taas*, which are very common in every part of China, the most remarkable are the magnificent porcelain towers of Nang-king and of Tong-chang-fou. They are generally octagons, divided into stories, which diminish gradually to the top. Each story has a kind of cornice, supporting a roof, which is surrounded by a narrow gallery and balustrade: copper bells are hung at each corner of the roof. They have commonly a long pole at the top, surrounded by several circles of iron, supported by eight chains, tied by one end to the top of the pole, and by the other to the angles of the roof of the highest story. One of these towers, which are found on the banks of the Ta-ho, between Canton and Hoang-pou, is represented in *fig*. 3. (plate C. 29). *Pagloas*, or triumphal arches, are also very common in China, but they are almost entirely destitute of grace or beauty.

The Chinese houses are perfectly

uniform in the shape and dimensions of their interior. One half of the ground they are built on is occupied by courts and narrow walks. A broad walk passes through the middle, on each side of which are the apartments, consisting of a saloon for receiving visits, a bedchamber, and sometimes a study or closet. Before each set of apartments is a court, with a fish-pond or cistern at its extremity, containing an artificial rock in the middle, on which bamboos and other plants grow. The sides of the court are ornamented with shrubs and flowers. The saloon, or great chamber, is from 18 to 20 feet long, and about 20 broad. The side which looks to the court is entirely open, but a screen of canes, let down at pleasure, keeps out the rain and the rays of the sun. The side walls are covered with screens to the height of three or four feet from the ground, and the rest covered with coloured or gilt paper. The bottom of the drawing-room is composed of folding doors, over which, is a lattice, covered with painted gauze, to admit light into the bed-chamber. The doors, which are of wood, are of very neat workmanship, and are ornamented with figures. A partition of folding doors separates the large room from the bedchamber, which, in warm weather, are left open all night to admit the cool air. A passage leads by the side of the bedchamber to the cabinet, which is enclosed by walls, and lighted by windows. The other apartments, such as the drawing-room, kitchen, servant's room, bath, counting-house, and towards the street the shop, occupy the remainder of the ground floor. The *leou*, or upper story, is divided into a number of halls, used occasionally as chambers for lodging strangers: over the shop are the rooms for the shop-keepers. The windows in China are universally made of thin transparent oyster shells. In one of the halls, commonly that next the door, are placed the image and altar of the domestic idol.

The materials used for building are wood; and bricks which are either simply dried in the sun, or baked in an oven. The walls are commonly about eighteen inches thick. The tiles are plain, and semi-cylindrical, the latter being laid on the joinings of the former. The wood work is always left uncovered withinside the ceiling, and is generally carved, or inlaid with ivory, copper, and mother-of-pearl. (Sir. W. Chambers.)

Chip, a piece cut by an acute-angled instrument.

Chisel, a tool for cutting by the impulse of pressure, or by the blows of a mallet. The *former* is used, first of all, after the work is scribed, with a mallet; the *pairing chisel*, with a fine smooth edge, is used without a mallet, to smooth the irregularities left by the *former*; the *skew-former*, is used for cleaning acute angles; the *mortise-chisel*, is narrow, but very thick and strong, and is used to cut deep square holes for mortises; the *gouge* has a round or curved edge; *socket-chisels* have their shanks with a hollow socket at top, to receive a strong wooden sprig, fitted in with a shoulder; the *ripping chisel* is a socket chisel of an inch broad, with a blunt edge, and no basil.

Chit, an instrument for cleaving laths.

Choir, (χορος, Gr.) the part of the church where the singers or choristers are placed. In the time of Constantine the choir was first separated from the nave. In the twelfth century they began to enclose it with walls, but the ancient balustrades have been since restored. In nunneries the choir was a large hall, separated from the body of the church by a grate.

Cholula, a town in Mexico, celebrated for its remains of ancient Mexican buildings. To the east of the town stands the famous pyramid or *teocalli*, the largest and most sacred temple in Mexico. At a distance it appears like a natural conical hill, wooded, and crowned with a small church, but as we approach, its pyramidal form becomes distinguishable, together with the four stories into which it is shaped, although covered with vegetation. It is compared by Humboldt to a square four times the dimensions of the Place Vendome at Paris, covered with a heap of bricks, of twice the elevation of the Louvre. The base is almost double that of the great pyramid of Cheops; but its height is very little more than that of the pyramid of Mycerinus. It appears to have been constructed exactly in the direction of the four cardinal points. It is built of unburnt bricks and clay, in alternate layers. In the interior, as in other *teocallis*, there are considerable cavities intended for sepulchres. The present road from Puebla to Mexico was cut through one side of this pyramid, in doing which a square chamber was discovered in the interior of the pyramid, built of stones, and supported by beams of cypress wood. It contained two skeletons, some idols of basalt, and a number of vases curiously varnished and painted. Humboldt examined the ruins of this chamber, and observed a particular arrangement of the bricks, tending to diminish the pressure on the roof. Being ignorant of the arch, the natives placed very large bricks horizontally, so that the upper course should pass beyond the lower. Similar work has been observed in Egyptian edifices. The height of the pyramid is 177 feet; the length of the base, 1,423; the ascent to the platform is by a flight of 120 steps. This elevated area, comprising about 3,500 square yards, was occupied by the temple of Quetzalcoatl, the god of air, in place of which now stands a small chapel to the Virgin.

In the construction, form, and object, of the Mexican *teocallis*, there is a striking analogy to the tumuli and pyramids of the old world. The temple of Belus was a pyramid, built of brick and asphaltum, solid throughout, and it had eight stories. A temple was erected on its top, and another at its base. In the *teocallis*, the lower temple is clearly distinguished from the temple on the platform in the letters of Cortes. The Babylonian temple served, as Diodorus Siculus tells us, as an observatory to the Chaldeans; and Mexican priests, we are told by Humboldt, made observations on the stars from the summit of the *teocallis*, and announced to the people, by the sound of the horn, the hour of the night. The pyramid of Belus was both a temple and a tomb, so was the tumulus (χωμα) of Calisto in Arcadia, described by Pausanias. The *teocallis* were the same, and the plain in which are built the houses of the sun and moon, at Teotihuacan, is called the *path of the dead*. The Egyptian pyramids, the triangular pyramid of the Scythian queen, mentioned by Diodorus; the fourteen Etruscan pyramids, which are said to have been enclosed in the labyrinth of king Porsenna at Clusium; the tumulus of Alyattes at Lydia; the sepulchres of the Scandinavian king Gormus, and his queen Daneboda; and the tumuli found in Virginia, Canada, and Peru, in which numerous galleries, built of stone, and communicating with each other by shafts, fill up the interior of artificial hills; are monuments of a similar character, but not surmounted with temples. Some of the pagodas of India, particularly that of Tanjore, bear resemblance to them.

In the neighbourhood of the great pyramid, Mr. Bullock examined two detached masses, constructed also of unburnt bricks and clay. The one to the north-east had been cut, or taken away; its sides were broken, and so perpendicular as to prevent access to its summit: the other appeared to have been a fortified place, with a ditch and a wall on the top, forming an enclosure nearly resembling the figure ∞, and about a hundred feet in length. He found here among the loose earth many human bones, pieces of red earthenware, and fragments of obsidian—the knives, spears, and arrows-heads of the ancient Mexicans.

Choragic Monuments, (from χορος, Gr.) were erected by the Greeks in honour of those who gained a prize as choragus, or leader of the chorus. See *Athenian Architecture.*

Chord, (*Chorda*, Lat.) the right line which joins the two ends of an arc.

Chorobates, (χοροβατης, Gr. from χορος a region, and βαινω I go,) a measure for land twenty feet in length, mentioned by Vitruvius. Millin supposes it to be a species of level, with two weights, to ascertain the falls of rivers, aqueducts, &c.

Chunam, see *Stucco.*

Church, (*circe*, Sax. *κυριακη*, Gr.) a building for the performance of public worship. The first churches were built on the plan of the ancient Basilicæ, some of which had been granted to the primitive Christians by Constantine. See *Basilica.* This style was followed by the Gothic and Saracenic. See *Gothic Architecture.* The following was the form of the ancient Greek churches. About a third of the space of the church was occupied by two porticos. The first, called *προναος*, was adorned on the outside with columns, and enclosed within by a wall, communicating by a door with the second. It was destined for the *energumeni* and penitents, in the first stage of their repentance. The second was termed *ναρθης*, (*ferula*) because those placed in it, who were the penitents of the second class, began to be subject to the discipline of the church. The second portico led to the *ναος* or nave, which occupied nearly another third. In the *ambo*, which was in the middle, or on one side of the nave, the deacons and priests preached and read. The nave was destined for the reception of the people; at its entrance was the font: beyond it was the *χορος* or choir, round, and set with seats. A flight of steps led from the choir to the sanctuary, which had three apsides in its length, a great one in the middle, under which was the altar, and two small ones: it was entered by three doors.

Churches were first introduced into Britain by the Romans. The ecclesiastical buildings of the Anglo-Saxons, who succeeded them, were at first very rude, and many of the Saxon churches were built only of oaken planks, and some even of wattles, thatched with reeds. Yet in the earliest period of Christianity, amongst the Anglo-Saxons, their better kind of churches were constructed of more durable materials, and in a more magnificent style.

The church of St. Peter's at York, which was erected shortly after the baptism of king Edwin in 627. is described by Bede, as a spacious and magnificent fabric of stone. In the church of St. Peter, in the monastery of Wearmouth, built by the famous Benedict Biscopius in 675, glass was first used in England, the windows of the most costly buildings having, previous to that period, been filled with fine linen cloth, or latticed wood-work. The cathedral church of Hexham, in Northumberland, built by Wilfrid, bishop of York, in 674, was a magnificent specimen of Saxon building. Richard, prior of Hexham, an Anglo-Norman historian, in whose time it still existed, celebrates its "crypts, and oratories subterraneous, with winding passages to them," and its walls, which "were of immense length and height, supported on columns of squared, varied, well-polished stones, and divided into three stories." "The walls themselves, with the capitals of those columns by which the walls were supported, as also the coved ceiling of the sanctuary, Wilfred decorated with histories, statues, and various figures, projecting in sculpture from the stone, with the grateful variety of pictures, and with the wonderful beauty of colours." Some, among whom we may instance Mr. Bentham, in his History of Ely Cathedral, have supposed that the early Anglo-Saxon churches were square, or rather oblong buildings, without a tower, as St. Peter's at York, begun by Edwin in 627, is reported by Bede to have been, and that they were generally circular at the east end, resembling almost exactly the basilicæ of the Roman empire. He supposes the cruciform shape, and the towers which rise above the roof, to have been introduced about the time of Edgar. But this observation cannot be universally applied. The church of St. Mary at Hexham, which was built in the seventh century by St. Wilfrid, is described by Richard, prior of Hexham, as being "furnished with a tower, of a round or cupola form, from which four porticos, or aisles, proceeded." The use of the towers is perhaps as old as that of bells to churches, which probably, amongst the Anglo-Saxons, preceded considerably this period. Dr. Milner, in his Ecclesiastical Architecture of the Middle Ages, observes, that "The use of small bells *(nolæ)* in this country, if we may credit William of Malmsbury, may be traced as high as the fifth century. And it is clear from Bede, that even those of the larger kind, *(campanæ)* such as sounded in the air, and called a numerous congregation to divine service, were employed in England as early as the year 680, being that in which the Abbot Hilda died." The general plan of the latter Saxon, and of the earliest Norman churches, was as follows: the chief entrance was at the west end into the nave; at the upper end of the nave was a cross, its arms extending north and south, and its head, which contained the choir, towards the east, ending commonly in a semicircle: in the centre of the cross, a tower contained the bells, and others were sometimes added for ornament: the nave, or often the whole building, was encompassed with inner porticos. During the time that this country was subject to the Danes, little alteration appears to have been made in its ecclesiastical architecture. Many have attributed to them the *round towers* which are found in some very ancient parochial churches. Of the churches which were built after the conquest, and which were exceedingly numerous, the chief characteristic difference from the old Saxon buildings of the same kind, is the magnitude and grandeur of their dimensions. The works of the Normans were large, sumptuous, and magnificent, carried up to a great height, with two and sometimes three ranges of pillars, one over another, connected together by arches, forming an upper and lower portico, with a gallery over them. On the outside were three tiers of windows. In the centre was a lofty strong tower, and one or two more were often added at the west end.

A church is said to be *in a Greek cross*, when the length of the transverse part is equal to that of the nave: *in a Latin cross*, when the nave is longer than the transverse part; *in rotundo*, when it is a perfect circle; *simple*, when it has only a nave and choir; *with aisles*, when it has a row of porticos, in form of vaulted galleries, with chapels in its circumference.

Ciborium, (*Κιβωριον*, Gr.) A small detached building, consisting of an arched vault, supported by four columns. In Catholic countries, the sculptured tombs of martyrs are called Ciboriums, when used as altars; the term is also applied to the coffer or case inclosing the host, and to any ornamented tabernacle unconnected with other buildings. Ciboriums are commonly seen in Italian and other continental churches, ornamenting tombs and altars; and Justinian, when he rebuilt the church of St. Sophia, in the twelfth year of his reign, erected a ciborium of unexampled elegance and beauty. Its dome of silver was surmounted by a golden globe weighing 118 pounds, and was supported by four pillars of red marble; lilies of gold weighing 116 pounds, encircling the dome, fell down from it in festoons on every side, and on the globe was a cross of gold, weighing 75 pounds, covered with rare and precious jewels. See *Baldachin*.

Cilery, ornaments of foliage and drapery on the heads of columns.

Cill, see *Sill*.

Cima, see *Cyma*.

Cimbia, a list, string, fillet, or cincture.

Cimeliarch, a name given to the apartment where the plate and vestments are deposited in churches.

Cincture, the circular concavity near the head or base of a column.

Cinquefoil, a five-leaved ornament, in circular and other divisions of the windows of ancient churches, and also on panels. It is a rosette of five equal leaves; when in circles, the leaves not formed by the solid parts, but by the open spaces, there is also an open space in the middle.

Cippus, the cippi were small columns by the sides of highways, generally bearing inscriptions significant of remarkable events, or used as land-marks, or for sepulchral inscriptions. They were frequently without capital or base.

Circle, (*Circulus, Lat.*) a figure contained under one line, called the circumference, to which all lines drawn from a certain point within it, called the centre, are equal. The circumference is supposed to be divided into 360 equal parts, called *degrees*, each degree is again subdivided into 60 *minutes*, each minute into 60 *thirds*, each third into 60 *fourths*, &c. ad infinitum. The circle is the most capacious of all plain figures. The area is equal to the area of a triangle, the base of which is equal to the circumference, and the perpendicular equal to the radius, or to a rectangle, whose breadth equals the radius, and whose length equals the half of the circumference. The ratio of the diameter to the circumference, was given by Archimedes, as 7 : 22, which is sufficiently near for common purposes. It was estimated by Vieta, by means of circumscribed and inscribed polygons of 393,216 sides, as 10,000,000,000: 31,415, 926,536. M. De Lagny, (Memoires de l'Acad. 1719,) carried the approximate ratio to 128 places of figures. The first who expressed the area of a circle, in terms of the diameter, by an infinite series, was Dr. Wallis, whose calculations have been improved upon by Sir Isaac Newton and Dr. Gregory. The following are the most convenient formulæ, for expressing the circumference, when a = circumference, and 1 = diameter.

$$(1)\ a = 4\times\left(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+\frac{1}{13}-\&c.\right)$$

$$(2)\ a = \sqrt{12}\times\left(1-\frac{1}{3.3^1}+\frac{1}{5.3^2}-\frac{1}{7.3^3}+\frac{1}{9.3^4}-\&c.\right)$$

$$(3)\ a = 8\times\left(\frac{1}{1.1.3}+\frac{1}{1.3.5}-\frac{1}{3.5.7}+\frac{1}{5.7.8}-\frac{1}{7.9.11}\&c.\right)$$

$$(4)\ a = 8\times\left(\frac{2}{3}-\frac{1}{5}-\frac{1}{4.7}-\frac{1.3}{4.6.9}-\frac{1.3.5}{4.6.8.11}\&c.\right)$$

$$(5)\ a = 4\sqrt{2}\times\left(2.\frac{1}{3}-\frac{1}{2}\cdot\frac{1}{5}-\frac{1}{4.2^2}\cdot\frac{1}{7}-\frac{1.3}{4.6.2^3}\cdot\frac{1}{9}-\frac{1.3.5}{4{\cdot}6.8.2^4}\cdot\frac{1}{11}\&c.\right)$$

$$(6)\ a = 4\times\left(1-\frac{1}{2}\cdot\frac{1}{3}-\frac{1}{2.4}\cdot\frac{1}{5}-\frac{1.3}{2.4.6}\cdot\frac{1}{7}-\frac{1.3.5}{2.4.6.8}\cdot\frac{1}{9}\ \&c.\right)$$

The following are a few of the most useful problems relating to the mensuration of the circle, and its various parts.

To find the radius of a circle, when the chord and height of arc are given, we must divide the sum of the squares of the height, and of the half chord, by twice the height, and the quotient will be the radius. Thus in *fig.* 4, (Geometry, Plate III.) Let the radius of a circle be required, that will describe an arc MAm, whose chord Mm is 16 feet, and its height AP, 5 feet.

64 sq. of ½ chord
25 sq. of height

2 × 5 = 10)89

8.9 or 8 ft. 10½ inch. Ans.

If it be required to find the height of the segment of a circle, when the radius and chord of the segment are given, extract the square root of the difference of the squares of the radius and half chord, and the difference between it and the radius of the circle is the height of the segment. Let the radius of the circle BDFE (*fig.* 5.) be 250 feet, and the chord DE of the segment DBE (*fig.* 5) be 12 feet, required the height BC of the segment.

62500 sq. of radius 6,24,64(249.927
36 sq. of ½ chor. 4

62464 44)224
176

489) 4864
4401

4989)46300
44901

250 rad. 49982) 139900
249,927 99964

.073, Ans. 499847)3993600
3498929

494671

When the radius and height of the arc of a segment are given, to find the cosine of the half arc. Substract the height of the arc from the radius, the remainder is the answer.

Given the radius, the cosine of the half arc, or the distance from the centre to a chord, and the distance of an ordinate of the segment, made by that chord, to find the ordinate. Substract the cosine of the half arc of the segment, from the square root of the difference of the squares of the radius and abscissa, the remainder will be the ordinate. The truth of this rule may be thus investigated. Let DBEF (*fig* 6.) be a circle, O its centre, DE a chord, C the middle of the chord, and PM the ordinate: draw OQ parallel to DE, and produce PM to Q. Let r = OB = OM the radius: d = OC = QP, distance of chord from centre: x = CP = OQ abscissa of segment from centre: y = PM ordinate. Then by Euclid (I. 47.) $(QM)^2 = (OM)^2 - (OQ)^2$ that is $(d + y)^2 = r^2 - k^2$. Therefore $y = \sqrt{r^2 - k^2} - d$. For an example of the application of this rule, it may be required to construct a segment of a circle of which the chord is 200 feet, and the radius of the arc 250. We must first find a sufficient number of points in the curve, by means of their ordinate: suppose them to be 10 feet from each other, and that their lengths in succession from the middle of the chord to each extremity, have been computed to be 20.871, 20.671, 20.070, 19.065, 17.651, 15.820, 13.565, 10.873, 77.26, and 4.110. Draw a straight line AC (*fig.* 8.) and raise a perpendicular DB, from the middle point D to the line AC. On this perpendicular set off the sagitta of the segment 20.871 from D to B. Mark off ten points on each side of D, at 10 feet distance, and from them draw as many perpendiculars, on which set off 20.070, &c. and their extremities with the tenth point, will be so many points in the curve. Find the sagitta to a chord of 12 feet, and the radius of 250. Draw a straight line 12 feet long: from the middle, raise a perpendicular, the length of the sagitta thus formed, and describe a segment of a circle to the chord 12 feet, and to the height of the sagitta. Having described the arc, form the edge of a board to the curve, put nails in all the points of the curve, *fig.* 8, and apply the curved edge successively upon every two adjacent nails, so that the concavity may be next the centre. In each application, draw a curve from one nail to the other, and the segment will be completed.

A circus or semicircular crescent may be constructed by multiplying the radius of the circle by the square root of ½, substracting the product from the radius, the remainder giving the height of the arc of the quadrant. For if we suppose ODBE (*fig.* 7.) to be a quadrant of a circle, and DE the chord of the segment, let r = OD = OB = OE, and s = CD = CO = CE, then, (since, by Eucl. I. 47, $(OD)^2 = (CD)^2 + (CO)^2 = 2\ (CD^2)$ $s = r\sqrt{\tfrac{1}{2}}$; but CO = s, therefore CO $= r\sqrt{\tfrac{1}{2}}$; but CB = OB − OC $= r - r\sqrt{\tfrac{1}{2}} = r\,(1 - \cdot 707106)$ or CD $= \cdot 292894 \times r$, therefore (supposing r to be 300 feet) $r = \cdot 292894 \times 300 = 87.8682$.

Circle, Druidical, see *Druidical Architecture.*

Circular Buildings, when of the same cylindrical form within as without, are called *Rotundas.*

Circumference, the boundary line of circular bodies.

Circumscribe, to draw a line

around, or to inclose any thing, so that the inclosed shall be touched on all its angles, or on its whole circumference, by the line or body that incloses it.

CIRCUMVALLATION, the surrounding of trenches, or fortifications, with a trench and parapet: commonly flanked with redoubts.

CIRCUMVOLUTIONS, a term applied to the spirals of the volute of the Ionic capital, which in some instances has three, but in the temple of Minerva Polias has four circumvolutions. See *Volute, Spiral, &c.*

CIRCUS, among the Romans, a large ovate building for the exhibition of popular games and shows; they were originally plain open race-courses, bounded on one side by the Tiber, and on the other by palisades of naked swords stuck in the earth; this was also the mode adopted by the Greeks on the borders of the river Alpheus.

The first stone circus was built by Tarquinus Priscus, between the Aventine and Palatine hills. This primitive erection occupied a space of more than three English furlongs in length, and 960 Roman feet in breadth. It was beautified and enlarged by succeeding emperors, and in the reign of Domitian was sufficiently capacious to accommodate 260,000 persons; with propriety retaining its ancient name of *Circus Maximus.*

These buildings were in the proportion of about five in length to one in breadth; their principal divisions in the interior were the *carcéres*, or starting place for the horses and chariots, at one end; the *area* or *arena*, the course passed over by the runners; the *meta*, a column of a conical form, at the end of the circus, around which the racers passed as they returned toward the starting post; the *stadium*, raised above the *arena* by which it was surrounded; the *spina*, a platform divided into nearly two equal parts, intersecting the *stadium* longitudinally, and ending at the *meta;* in its whole course, the *spina* was ornamented with statues, columns, and trophies, and in the centre was a temple usually dedicated to the sun. The *podium* was the open space on each side, and in front of the *orchestra*, of which it formed the principal part, both being for the accommodation of the higher orders of the spectators; the *euripus* was a reservoir of water passing along the side of the *podium*, which it separated from the arena. Over the *orchestra* was a gallery for the inferior class of citizens.

Rome contained numerous circuses besides the ancient one distinguished by the name of *Maximus*, of which the following were the principal.

The *Circus Flaminius* was built by the consul Flaminius, near the *Portus Carmentalis;* the place it occupied, now forms the site of the church and monastery of St. Katherine. The *Circus Alexandrinus*, erected by Alexander Severus, in the modern era of Rome named *Circus Agonalis*, and stigmatised as the place of the martyrdom of St. Agnes: this building was near the baths of Severus in the place now called Piazza Navona. The *Circus Sallustius*, built or restored by the historian of that name. The *Circus Florialis*, or *C. Vaticanus*, begun by Caligula, and finished in a splendid style by Nero. The celebrated obelisk in the centre of the peristile of St. Peter, was taken from the spina of this circus. Great numbers of the early Christians suffered martyrdom in this circus, and Nero enjoyed the savage pleasure of beholding their torments. Nero also built another circus in the gardens of Domitia his aunt, called *Circus Domitia;* and there were also those of Antoninus and Aurelian, of Heliogabalus, and, according to some writers, a circus near the gate of St. Sebastian, attributed to Gallienus.

For enlarged accounts on this subject, *Salmasius's Observations on Solinus*, the ninth volume of the *Tresor de Grævis*, and fifth volume of *Polenus*, may be consulted with advantage. The name of *Circus* is given, by modern architects, to circular ranges of elegant mansions; and those built in the form of segments of circles, are called *Crescents.*

CISOID, a curve line invented by the Greek geometrician Diocles.

CISTERN, a reservoir for water, either sunk below the surface of the earth, or formed of planks of wood. In the construction of an earthen cistern, a well-tempered stratum of clay must be laid as a foundation for a brick flooring, the bricks to be set in terras-mortar; the sides must be built with the same materials, and if in a cellar or other place near a wall, a space must be filled with clay, from the foundation to the top of the cistern, contiguous to the wall, to preserve it from injury.

A wooden vessel of this description is made of plain yellow deal planks of 2 or 2½ inches, according to its dimensions. The uprights may be 4 inches by 6, and placed 2½ feet from each other. The planks must be jointed with white lead, and strongly secured with two wooden pins, at each intersection of the uprights; it should then be placed firmly on a well-tempered bed of clay; a wall of stone or bricks must inclose this cistern, at the distance of 8 or 12 inches, and this space must be filled with clay.

For dry and elevated situations, leaden cisterns are generally used.

CITADEL, a small castle or fortress, generally occupying the highest part of a city, as its strong hold, from whence supplies and forces may be derived till the last extremity. The most celebrated building of this description was the Acropolis of Athens.

CITY, generally understood to apply to the capital towns in a country, as Philadelphia or Washington, in America; Edinburgh and Glasgow in Scotland. In England a city is defined to be "a town corporate, having a bishop, and a cathedral church."

CIVIC CROWN, a garland of oak leaves and acorns, given as an honorary distinction, among the Romans, to such as had preserved the life of a fellow-citizen.

CLAMP, see *Brick.*

CLAMPING, the act of securing a board with cross pieces at each end.

CLARO-OBSCURO, See *Chiaro-oscuro.*

CLATHRI, in Roman architecture, bars of iron or wood, which were used to secure doors and windows.

CLAY, a kind of earth, to which the name of argilla, or argillaceous earth, was formerly given, but which is now called, by the chemists, *alumine;* a substance forming part of the boles, marles, slates, scistuses, and mica. Besides numerous uses of clay, as it is found variously compounded with other substances, it is most extensively useful in brick-making. See *Bricks.*

CLAYES, in fortifications, wattles made with stakes, interwoven with osiers, to cover lodgments.

CLAYING, is the operation of covering a vessel with two or three coats of clay, to prevent water from running out.

Clean, a term used in some places, with the same signification as *to stick*, or *to glue*.

Clear, the distance between any two bodies, where no other intervenes, or between their nearest surfaces.

Clear Story Windows, such as have no transom intersection.

Cleats, small wooden projections on the decks, sides, and shrouds of ships, to fasten the ropes to.

Cleeta, the name of a Greek architect and sculptor. He was the builder of the magnificent Palæstra near Olympus, in which the races were performed at the Olympic games. He was so vain of his performance, as to place under one of his statues this inscription: "Cleeta, the son of Aristocles, who invented the Palæstra of Olympus, did this."

Clefts, often appear in green timber, which is very apt to split and cleave in several places, after it is wrought into form. The common method used by the carpenter to fill up these cracks, is with a mixture of gum and sawdust: but the neatest way is to soak both sides well with the fat of beef broth, and then dip pieces of sponge into the broth, and fill up all the cracks with them; they swell out so as to fill the whole crack, and so neatly as to be scarcely distinguishable.

Cleopatra's Needles, a name commonly given to two obelisks of Thebaic stone, on the east of the palace of Alexandria. One has been thrown down, and buried in the sand, the other is still erect, and consists of a single stone 60 feet high, and 7 feet square at the base. They are covered with hieroglyphics.

Clepsydra, (Κλεψύδρα, Greek, from κλεπτω, *to conceal*, and ὕδωρ, water.) A vessel or building used to measure time by the running out of a certain quantity of water, or sometimes of sand. The first building erected for the measurement of time was the dial, but as this only showed the hour when the sun appeared, the clepsydra was invented to supply its place in wintry and cloudy weather. They were first used by the Egyptians. Tycho Brahe made use of one, to measure the motions of the stars, &c., and Dudley used the same contrivance in making all his maritime observations. Considerable improvements have been made in this instrument by M. Amontons. For a description of the celebrated clepsydra of Andronicus Cyrrhestes, see the article *Athenian Architecture*.

Clinching, is the driving of the point of a nail backward, when it has penetrated quite through a piece of wood, with a hammer pressed against its head.

Clinkers, bricks impregnated with nitre, and more thoroughly burnt, by being placed next to the fire in the kiln.

Cloacæ, the common sewers of ancient Rome, made to carry off the filth of the city into the Tiber. The chief of these, called the *Cloaca Maxima*, was built by the first Tarquin, of huge blocks of stone joined together without cement; it consisted of three rows of arches one above another, which at length conjoin and unite together. They measured clear 18 palms in height, and the same in width. Under these arches they rowed in boats, and by them were ways through which loaded carts could pass. It began in the Forum Romanum, was 300 paces long, and entered the Tiber between the temple of

Vesta, and the Pons Senatorius. There were as many principal sewers as there were hills in the city.

Cloister, (*claustrum*, Latin.) the principal part of a regular monastery, consisting of a square peristyle or piazza, between the church, the chapter-house, and the refectory, having over it the dormitory, and often enclosing the cemetery. According to Peter of Blois, the monks used to hold their lectures in them: Lanfranc says that their proper use was for the monks to meet and converse in at certain hours of the day. The principal cloisters in England are in the Gothic style. In Italy they are often arcades, supported on piers, or columns of various orders.

Close String, in dog-leg stairs, a staircase without an open newel.

Closer, the last stone in the horizontal length of a wall, which is of less dimensions than the rest, to fill up the row.

Closet, a small apartment communicating with a larger one.

Clough, a paddle or sluice in a pond or canal.

Clough Arches, or **Paddle-Holes**, crooked arches by which the water is conveyed from the upper pond into the chamber of the lock of a canal, on drawing up the clough.

Clustered, in architecture, the coalition of several members which penetrate each other.

Clustered Column, several slender pillars, attached to each other so as to form one. The term is used in Roman architecture, to denote two or four columns, which appear to intersect each other at the angle of a building or apartment, to answer to each return.

Coating, the covering any thing with several thicknesses.

Cocking. See *Cauking*.

Cockle Stairs, a winding staircase.

Cœmetery, see *Cemetery*.

Cœnaculum, (Lat.) properly the eating or supper room of the ancient Romans. In the early periods of their history, when their houses consisted rarely of more than two stories, it denoted generally the upper story. It also denoted lodgings let out for hire, and also the upper stories of the circusses, which were divided into small shops or rooms, that were let out for hire.

Cœnatio, (Lat.) an apartment in the lower part of the Roman houses, or in a garden, to sup or eat in. According to Suetonius, it denoted a banqueting and summer house. The younger Pliny describes a spacious cœnatio in his Laurentine villa, in the superior part of a lofty tower.

Coffer, (*Cofre*, Saxon,) a recess used anciently in level soffits, and in the intradoses of cylindrical vaults. They recede like inverted steps around the panel, each internal angle being filled with mouldings. The panel at the bottom is generally covered in Roman works with a rosette. They are also used between the modillions in the soffits of the cornices of the Greek and Roman orders. In inland navigation, the *coffer* is a substitute for a lock.

Coffer Dam, a hollow dam, formed by a double range of piles, with clay between, to protect the workmen in digging and building foundations in canals, &c.

Coffer Dam, or *Battardeux*, a frame used in the building of a bridge in deep water, similar to the *caisson*. They are made either single or double. Clay or chalk is rammed between the double enclosures; the enclosures are made with piles driven close together, and grooved and tongued: the piles are sometimes grooved in the sides, and fixed with boards let into the grooves.

Cogging, the same as *cocking*.

Coin, (*coin*, Fr. *a corner*,) in building, the angle made by two surfaces.

Coin, (*cuneus*, Lat. *a wedge*,) a block to support a column or pilaster on an inclined plane, cut obliquely at the bottom.

Colarino, (*colarin*, Fr.) another name for the *astragal*.

Collar-Beam, a beam above the lower ends of the rafters of a roof. They are formed into queen-posts in trussed roofs; but in common roofs, into the rafters themselves. See *Truss*.

College, (*collegium*, Lat.) an edifice endowed with revenues for the education of youth in the higher branches of study. It generally consists of one or more spacious courts, encircled by buildings. The *Collegio Romano de Gesuiti*, at Rome, built by Bartolomeo Ammanati, is a very large and handsome structure. The large quadrangle has two stories of arcades, which serve as porticoes, and is decorated with pedestals, pilasters, and sculptural ornaments.

Cologne Earth, a colour of a deep brownish tinge. It contains more vegetable than mineral matter, and originates from the remains of wood long buried in the earth.

Colonelli, (It.) the posts of a truss frame.

Colonnade, (*colonnata*, It.) a row of columns. The colonnade is termed, according to the number of columns which support the entablature, *tetrastyle*, when there are four; *hexastyle*, when six; *octastyle*, when eight, &c. When in front of a building, they are termed *porticos*, when surrounding a building *peristyle*, and when double or more, *polystyle*. They are also called according to the intercolumniation, *pycnostyle* when it is one diameter and a half, *systyles* when two diameters, *eustyle* when two and a quarter, *diastyle* when three, and *aræstyle* when four.

The Egyptians made very frequent use of colonnades, some of their temples being literally thick-set with them, both in the interior and exterior. The Greeks most commonly used colonnades as porticoes and peristyles. The temple of Jupiter Olympius at Athens, is a magnificent example. We never find columns grouped or clustered in the works of the ancients: in the temple of Bacchus at Rome, are columns standing as though in pairs, but each pair being only placed in the thickness of the wall, they may be rather said to be two more immediately behind each other. Groined ceilings, supported by single Corinthian columns, are found in the baths of Dioclesian, and in the temple of Peace at Rome. The magnificent colonnade of the Piazzo di San Pietro at Rome, the work of Bernini, consists of two hundred and eighty columns and forty-eight pilasters, of forty feet high, raised on three lofty steps, and surmounted by a balustrade on which are eighty-eight colossal statues of saints, 15 feet high.

Colosseum, or *Coliseum*, the name given to the immense amphitheatre built by Flavius Vespasian, A.D. 72, after his return from his victories over the Jews, thirty thousand of whom are said to have been employed five years in its construction. It would contain ninety thousand persons sitting, and twenty thousand more standing, in various places, who were called *excuneati*. See *Amphitheatre*.

Colossus, (Κολοσσος, Gr.): the name of a brazen statue of Apollo at Rhodes, so large that ships could sail between its legs: it was the work of Chares, the disciple of Lysippus. Its height was 105 feet. It was cast hollow, and filled with large stones to counterbalance its height; a winding statue led to the top, where a vast mirror was hung round the neck of the statue, in which might be discerned the country of Syria, and ships entering the ports of Egypt. About sixty years after its erection, it was thrown down by an earthquake, which broke it off at the knees, and in that state it remained till the conquest of the island by the Saracens, who beat it to pieces, and sold it to a Jew merchant, who loaded above 900 camels with the brass. From the name of this statue originated the Greek proverb *Κολοσσαιον το μεγεθας*, and the term has since been applied to every statue of more than ordinary dimensions.

Columbarium, (Lat.) a pigeon-house. *Columbarium Fictile* was an earthen pot for birds to breed in. The term *Columbaria* was also applied to the apertures that were formed in the wall for the reception of the cinerary urns in the ancient Roman cemeteries. See the plates entitled *Ancient Roman Ornaments;* and the article *Urn.*

Collumellæ, another name for balusters.

Column, (*columna*, Lat.) a round pillar, the parts of which are the *base*, on which it rests, its body called the *shaft*, and the head called the *capital.* The capital finishes with a horizontal table called the *abacus*, and the base commonly stands on another called the *plinth.* See *Base*, *Capital*, *&c.*

Attached columns were very seldom employed in Greece; the only instances known are the monument of Lysicrates, and the temple of Minerva Polias; the columns of the temples at Agrigentum in Sicily are also attached. Attached columns occur more frequently in Roman edifices, as in the Temple of Fortune, the Arch of Titus, the Colosseum, and the theatre of Marcellus. Columns are either *plain* or *fluted*, and the flutes, and mode of dividing them, are different in the Doric and Corinthian orders. The Ionic and Corinthian flutes are very similar. Twisted, spiral, and rusticated columns are never introduced in works of good taste. *Cabled* or *rudented* columns have the flutings of the shaft filled with astragals to about one-third of the height. *Carolytic* columns have foliated shafts. Columns were often used for *monuments*, like the Trajan and Antonine columns at Rome, and the Monument in London. Catherine di Medici erected an astronomical column at the Halle au Blid in Paris. The Romans had a *columna bellica* near the temple of Janus, from whence the consul proclaimed war by throwing a javelin towards the enemies' country. The *chronological column* bore an inscription in remembrance of historical events, the *cruciferal column* bore a cross on its summit, the *funereal column* an urn; the *zoophoric column*, an animal; the *genealogical column*, an inscription relating to genealogy or heraldry; the *gnomic column*, a dial; the *itinerary column* pointed out the various roads diverging from its site. The Romans had a *lacteal column* erected in the vegetable market, which contained in its pedestal a receptacle for infants that were abandoned by their parents (Juvenal. Sat. vi. 601), on the *legal column* the ancients engraved their laws; the boundaries of a province were marked by the *boundary*, or *limitative column*; the *manubial column* was adorned with trophies and spoils, and the *rostral column* with the prows (*rostra*) of captured ships. The *sepulchral column* was erected on a tomb, the *triumphal column* in commemoration of a triumph.

The triumphal *column of Antonine* was erected to the glory of Marcus Aurelius, in the time of Commodus, for his victories over the Marcomani. He afterwards dedicated it to his father-in-law, Antoninus Pius. It was repaired by Fontana in 1589, under Sextus V. who placed on its summit a colossal statue of St Paul, with this inscription: SEXTUS V. PONT. MAX. COLUMNAM HANC COCHLIDEM, IMP. ANTONINO DICATAM, MISERE LACERAM RUINOSAMQUE, PRIMÆ FORMÆ RESTITUIT, AN. MDLXXXIX. *Pont. IV.* According to the admeasurement of M. de la Condamine, it measured 116 French feet in height, and eleven in diameter. It is entirely of marble, and encircled with bassi relievi, which form twenty spirals around its shaft. For accounts of *Pompey's Pillar* and *Trajan's Column*, see those articles. The *milliary column* or *milliarium aureum* of Rome was originally a column of white marble erected by Augustus in the Forum, near the temple of Saturn, as a centre whence the calculation of distance began from the city. It is still preserved in the Campidoglio. It is a short column, with a Tuscan capital, and has a ball of bronze for a finial. It was formerly gilt over.

According to Vitruvius, columns at angles should be thicker than the intermediate ones; the diameter of columns should be proportioned to the intercolumniation; the higher they are, the less should be their diminution; that those on the flanks and angles should have their inner faces towards the walls perpendicular; that the two middle columns opposite the entrance, should be wider apart than any of the two others; that in theatres, and works of gaiety, the columns should be differently proportioned from those in sacred edifices. On the proportions of the shaft, see *Shaft*.

COLUMNARIUM, a heavy tribute, first levied by Julius Cæsar on every column of a house, to put a stop to the extravagant expense laid out on sumptuous buildings.

COMA, (κωμα, *sleep*, Gr.) in antiquity, a mound of earth over a grave.

COMITIUM, (Lat.) a building in the Roman Forum, wherein assemblies of the people were held. It occupied the entire space between the Palatine hill, the Capitol, and the Via Sacra. Until the year in which Hannibal first entered Italy, it was open to the air, but it was afterwards covered with a roof supported by beautiful fluted Corinthian columns. Three of them are still standing near the church of Santa Maria Liberatrice. Excavations have been made at their base by order of Pope Pius VII., which have discovered remains of the ancient buildings.

COMMISURE, (Lat.) the joint between two stones.

COMMON, a line, angle, surface, &c., which belongs equally to several objects. *Common Centering*, is a centering without trusses, having a tie-beam at the bottom. *Common joists*, are the beams in naked flooring, to which the joists are fixed. *Common rafters*, in a roof, are those to which the laths are attached.

COMPARTED, (*compartir*, Fr. *to divide*,) divided into several parts.

COMPARTITION, the distribution

of the ground plan of an edifice into rooms and passages.

Compartment Ceiling, a ceiling divided into panels, surrounded with mouldings.

Compartment Tiles, an arrangement of white and red tiles, varnished, on a roof.

Compasses, (*compas*, Fr.) a mathematical instrument, to draw circles, and measure distances between two points. Common compasses have two legs, moveable upon a joint. Triangular compasses, have two legs like common compasses, with a third leg fixed to the bulb by a projection, with a joint, so as to be moveable in every direction. Compasses composed of a beam, with a fixed point at one end, and a moveable one at the other, are called *beam compasses*. *Proportional compasses* have a joint between the extremities, and two sharp points at each end, forming a double compass, so that the two ends may always preserve the same ratio. If the joint be moveable, it is called a compound proportional compass.

Compassing, (*compasse*, Fr.) in naval architecture, bringing a piece of timber into the form of an arch.

Complement, (*complementum*, Lat.) the number of degrees which any angle wants of a right angle. The complement of a parallelogram is two lesser parallelograms, made by drawing two right lines parallel to the sides of the quarter, through a given point in the diagonal.

Compluvium, (Lat.) a void space in the centre of Roman buildings, to receive the waters that fell from the roof; also the gutter or eaves.

Composite Order, see *Order* The *Composite arch* is the pointed or lancet arch.

Concamerata Sudatio, (Lat.) the apartment in the ancient gymnasium, between the *laconicum* or stove, and the warm bath; where the wrestlers and racers retired, to wipe the sweat from their bodies.

Concamerate, (Lat.) to arch over.

Concatenate, (Lat.) to link together.

Concave, (*concavus*, Lat.) hollow.

Concavity, of a curve line, is the side between the two points of the curve, next to a straight line. The concavity of a solid, is such a curved surface, that if any two points be taken in it, the straight line between them is in a void space, or will coincide in only one direction with the surface.

Concentric, (Lat.) having a common centre.

Conchoid, a curve line, discovered by Nicomedes, which always approaches a straight line, but, though produced ever so far, never meets it.

Conclave, (Lat.) the place in the Vatican where the cardinals meet to choose a new pope. It consists of a suit of grand halls or corridors, with rows of cells formed on each side, of equal dimensions, two of which are allotted to each cardinal, one for himself, the other for his officer, called the conclavist, and his valet de chambre. The word was used by the ancient Romans to denote any room under lock and key.

Concord, *Temple of*, at the foot of the capitol, built by Camillus. There still remains a hexastyle portico, with two Ionic columns at the back. The entablature, a large part of the tympanum, and part of the pediment, are also preserved. The columns are of granite, each of one piece, 40 feet high, and 2 feet 2 in diameter. The capitals have the four faces alike. The volutes are very minute, and the mouldings too large. The weight of the tympanum is discharged from the entablature with arches. The architrave and frieze make but one course in height, and the cornice has both modillions and dentils. It is supposed to have been pseudoperipteral.

Concretion, (Lat.) the hardening of soft bodies.

Concurring, or Congruent, such figures or solids as fill exactly the same space.

Conduit, (Fr) a long narrow passage between two walls, or underground, for secret communication between different apartments. Also a canal or pipe for the conveyance of water.

Cone, (κωνος, Gr.) a solid which is bounded by two surfaces, of which one called the *base* is a circle, and the other, ending in a point called the *vertex*, a convexity; so that a straight line drawn from any point in the circumference of the base to the vertex will coincide with the convex surface. If the *axis*, or the straight line drawn from the centre of the base to the vertex, be perpendicular to the base, it is termed a *right cone;* if not, it is an *oblique cone*.

Confessional, (Lat.) a cell in Catholic churches, where the confessor sits to hear confessions. It is generally of wood, and divided into three niches or cells, the central one, which is for the priest, having a seat in it, and being closed half way up by a dwarf door.

Configuration, the exterior superficies of a body.

Conge, (Fr.) the same as *Apophyge*.

Conic Section, the figure formed by cutting a cone by a plane. They are five, corresponding to the positions of the plane—a *triangle*, a *circle*, an *ellipse*, a *parabola*, and an *hyperbola*. Only the last three of these, however, are termed peculiarly conic sections.

Conisterium, (κονιστρα, Gr.) an apartment in the gymnasium and palæstra of the ancients, where the wrestlers sprinkled themselves with dust, after being anointed with oil, that they might take the surer hold of each other.

Conjugate Diameters, two diameters in an ellipsis or hyperbola, parallel to tangents at each other's extremities.

Conoid, (κονοειδης, Gr.) a figure produced by the revolution of a conic section round one of its axes.

Conservatory, (Lat.) a building for the protection of tender plants. It is often attached to the house as an apartment, for the display of scarce exotics, during the time of their greatest beauty and perfection. It should be in a very dry situation, and, if there be no shed behind, the walls should be at least three bricks thick.

Consistory, (Lat.) the judicial hall of the college of Cardinals at Rome.

Console, (Fr.) the same as an *Ancone*, which see. In the palace of Dioclesian, at Spalatro, consoles are used to support an entire order of columns.

Constantinople. The buildings of the Ottoman capital are interesting in two points of view, both as exhibiting specimens of the architecture of the Western empire, and of that of the Turks. The architecture of Pagan, Christian, and Moslem, are promiscuously blended.

At the top of the ancient Byzantium, and of an eminence that descends gradually down to the sea by the point of the seraglio, is the mosque of St. Sophia. The plan of this fine structure is almost a square. The dome rests outwardly on four prodigiously large towers, which have been added of late years. The entrance is by a portico six toises broad, which in the time of the Greek emperors served for a vestibulum. This portico communicates with the church by nine marble folding doors, the leaves of which, being of brass, adorned with basso-relievos, are very magnificent. The vestibulum is joined to another, which is parallel to it, but has no more than five brazen doors without bas-reliefs; the leaves were charged with crosses, but these last have been mutilated by the Turks. These two vestibules are only entered by doors on the sides, and, according to the rules of the Greek church, were necessary for the placing of those that were either about to receive the sacraments, or to undergo public penance. Parallel to them, the Turks have built a great cloister, for lodging the officers of the mosque. A splendid dome occupies the place of a nave, at the foot of which runs a colonnade, which bears a gallery of exquisite arch-work five toises broad. By some it is called Constantine's gallery; it was formerly set apart for the women. At the roof, and on the cornice of the dome, runs a small gallery, or rather balustrade, just broad enough for one person to pass. Above it there is also another. The columns of this dome have scarcely any swelling, and their chapiters looked to be of a singular order. The dome is 18 toises from wall to wall, and rests upon four huge pillars, about eight toises thick: the arch seems a perfect hemisphere, illuminated with twenty-four windows, disposed in a circumference. From the east part of this dome, you pass straight on to the demi-dome, which terminates the edifice. This was the sanctuary of the Christians, and now contains the niche where the Koran is kept, and close by it is the Mufti's chair.

This mosque, built like a Greek cross, is in the clear 42 toises long, 38 broad, nearly all of which is taken up by the dome. It is said to contain no fewer than 107 columns of different marble, of porphyry, or Egyptian granite. The whole dome is lined with varieties of marble: the incrustations of the gallery are mosaic, mostly made of cubes of glass, which are loosened every day from their cement, but their colour is unalterable. The Turks have destroyed the noses and eyes of some figures, as well as the faces of four cherubims placed in the angles of the dome.

"I know of no monument of antiquity," observes Mr. Hobhouse, "which has excited so much curiosity, both amongst the learned and the unlearned, as St. Sophia. For its dimensions and integrity, it may be thought incomparably more curious than any other relic of former ages; but in every other respect it must disappoint any sanguine expectation. Its external appearance is that of a vast building, whose ill-sorted construction requires a proportionate heaviness of mass to preserve it standing and entire. The weighty buttresses and the attached compartments of the temple, falling in a succession of penthouses, from the spring of the arch to within a few feet of the ground, nearly conceal, and totally ruin, any effect which might otherwise be produced by the height and expanse of its far-famed dome. The interior, to which you descend by five steps, seems at first sight magnificently spacious, and not broken with the aisles and choirs, nor deformed by the railings and tombs of modern churches, but your admiration diminishes as you proceed with your inspection. The beauty of the variegated marble floor is concealed by a covering of mats; and the dome, as well as the body of the building, is spoiled by a thousand little chords depending from the summit, within four feet of the pavement, and having at the end of them, lamps of coloured glass, large ostrich-eggs, artificial horse-tails, vases and globes of crystal, and other mean ornaments. The columns appear too large for the arches which they support, and the carving of their capitals can scarcely be more painful to the eyes of an architect, than to those of a common observer. Grelot knew not to what order they belonged, or by what name to describe their style, unless he called it a sort of Gothicised Greek.—My general impression was, that the skill of the one hundred architects, and the labour of the ten thousand workmen, the wealth of an empire, and the ingenuity of presiding angels, had raised a stupendous monument of the heavy mediocrity which distinguished the productions of the sixth century from the perfect specimens of a happier age."

The other royal mosques of Constantinople may be considered as so many copies of St. Sophia. They always stand by themselves in an enclosure planted with trees, adorned with fountains, oratories, &c. They have generally from two to six minarets. At the ancient Hippodrome, now called Atmeidan, is a mosque, each minaret of which has three stone galleries. The entrance is through a peristyle, a kind of arched cloister, covered with little domes, and supported by columns. One of the most splendid mosques in Constantinople is that of Solyman II. The outside excels even that of St. Sophia; its windows are larger and better disposed, its galleries more regular and stately. It is an exact square, with four fine towers at the angles: in the midst is a noble cupola, supported by marble pillars, and two lesser at the ends, supported in the same manner. Under the great cupola, as in other mosques, there is a fountain, adorned with marble pillars. The spacious court leading to it, which contains another, has marble galleries, covered with twenty-eight leaded cupolas. This mosque is built of the finest stones that could be found among the ruins of Chalcedon. The mosque of Valide, the mother of Mahomet IV. is near the Seraglio. The inside is lined with fine Dutch ware; but its colonnade is of marble, taken chiefly from the ruins of Troy, with chapiters. The arches over the doors and windows are well designed; its two minarets have each three handsome galleries.

The Seraglio, which was built by Mahomet II., is nearly three miles in circuit: it is a kind of triangle, whose side next the city is the largest. The apartments are on the top of the hill, and the gardens below stretching to the sea:—"Though I saw only the outside of the Seraglio," says Tournefort, "I am persuaded that its inside can show nothing of what we call stately and noble; because the Turks have hardly any notion of magnificence, and follow no one rule of good architecture." The apartments have been made at different times, according to the caprice of the princes and sultanas, so that this famed palace is little better than a disorderly heap of houses clustered together. Marble basins, bagnios, and spouting fountains, are placed on the first floor, without any fear of preserving the ceiling. The principal entrance is a huge pavilion, with eight openings over the gate, or *porte.* This Porte, from which the Ottoman empire took its name, is very high, simple, semicircular in its arch, with an Arabic inscription beneath the bend, and a niche on each side. It looks more like a guard-house than the entrance to a palace. This entrance leads into a large court-yard, not so broad as long. The second court is a square of 300 paces, much handsomer than the first, covered with turf and fountains. On the left are the Grand Seignior's treasury, and little stables: on the right are the offices and kitchens, embellished with domes, but without chimneys. A low gallery, covered with lead, and supported by columns of marble, runs all round. At the further end of this court, on the left, is the hall where the divan is held; on the right is a door which leads into the Seraglio, through which none pass but such as are sent for. The hall of the divan is large, but low, covered with lead, wainscoted and gilt after the Moorish fashion. Thus far only are strangers allowed to enter the Seraglio.

The Mosque of the Arabs, in the suburb of Galata, was a church of the Dominicans, as ancient as the time of St. Hyacinth. No alteration has been made in it; the Gothic windows and inscriptions on the gates still remain, and the belfry, which is a square tower, serves for a minaret.

The Hippodrome of Constantinople is still used as a place for exercise in riding. It is called by the Turks Atmeiden, from *At*, a horse, and *meiden*, a place. It is about 250 paces long, and 150 wide. It still contains the obelisk of granite, or Thebaic stone, which is a four-cornered pyramid, of one single piece, 50 feet high, terminating in a point, and charged with hieroglyphics. By the Greek and Latin inscriptions at the base, we learn that the emperor Theodosius caused it to be set up again, after it had lain a considerable time on the ground. The machines made use of in rearing it are represented in bas-relief. Here are also another obelisk, which appears to have been covered with brass plates, with some other antiquities.

The Bazaars are large square buildings, covered with domes, and supported by arches and pilasters. At the furthest part of the town, towards the sea of Marmora, is the celebrated castle of the Seven Towers. "The appearance of these walls," Mr. Hobhouse observes, "(the work of the second Theodosius,) is more venerable than that of any other Byzantine antiquity; their triple ranges, rising one above the other, in most places nearly entire, and still retaining their ancient battlements and towers, are shaded with large trees, which spring from the fosse, and through the rents of repeated earthquakes. The intervals between the triple walls, which are eighteen feet wide, are in many places choked up with earth and masses of the fallen ramparts, and the fosse of twenty-five feet in breadth, is cultivated and converted into herb-gardens and cherry orchards, with here and there a solitary cottage. Such is the height of the walls, that, to those following the road under them on the outside, none of the mosques or other buildings of the capital, except the towers of Tekkuri-Serai, are visible."

CONSTRUCTION, (Lat.) the describing a diagram, &c. from a given data. The art of building from the architect's designs.

Constructive Carpentry.—Under the article *Carpentry*, an historical view has been given of the various improvements which have from time to time been introduced into the practice of that art. In the present article, we shall give as comprehensive a view as the nature of our work will allow, of the modern practice of Carpentry.

We shall commence with the *scarfing* of timber, or the joining of two separate pieces by a close joint, a portion of the end of one piece lapping over the end of the other, and the sides of both making one continued surface. The perfection of this operation consists in making the joint as nearly equal as possible in strength to either piece taken separately. This is done sometimes by forming the ends of the two pieces to fit each other closely, and at others by the insersertion of a third piece. The ends of the pieces must be so indented as to resist a longitudinal strain. This is termed *tabling*. One single *table*, or one resisting abutment, is both stronger and easier to execute, than two or four. It must also be further observed, that the least possible projection should be given to the resisting part, as the cohesive force is diminished by it, by a quantity of timber equal to the parts that abut. A tapering mortise may be used instead of the abutments, the two pieces being brought in close connection by a wedge driven into the cavity. Iron bolts are the most convenient means of compressing the joint equally on each side, because they need to be thinner, and consequently require a less bore for their reception, than wood. A long scarf will allow of more bolts, and is consequently stronger, than a short one. The strength is also increased by the number of steps, or abutments. The scarfing of beams will be further illustrated by the *Plate*, Carpentry, C 12. The principle of *joining* timbers will be best understood by *Plate* Carpentry, C 7. It may be done either by making both planes of contact either at right angles, or parallel with the fibres, or the joint parallel with the fibres of one piece, and at angles with those of the other. A *longitudinal joint*, is that in which the common seam runs parallel with the fibres of both, in which case, bolts and pins are commonly used. In an *abutting*, or *butt-joint*, the plane of the joint is at right angles to the fibres, and the fibres of both pieces in the same straight line. When the joint is at right angles to the fibres of one piece, and parallel with those of the other, it is a *square joint*; when parallel with the fibres of one, and oblique to those of the other, a *bevel joint;* and when at oblique angles with the fibres of both pieces, a *mitre joint*. Butting and mitre joints are seldom used. The most common form of joining is by notching, in which we may vary the form of the joint, according to the number of angles, the position of the sides of the pieces, and the direction or quantity of the stress. The angles may be from one to four: joining by mortise and tenon only admits of one and two. Dove-tail notching is chiefly applicable to horizontal framing. When binding joints have a great strain at their extremities, a shorter bearing tenon should be attached to the principal tenon, with a sloping shoulder above, called a *tusk:* this kind of tenons are called *tusk tenons*. In Constructive Carpentry, *pl.* I. A and B shows the best methods of trussing *girders:* C the horizontal section of B; D the section of the abutment by cutting through *a b* in A; E and F show the two sides of the king-bolt at a in A, which incline to each other so as to form a wedge, and thereby force the trusses upon their abutments. Girders are trussed to counteract the effect of the bending to which they are subject when extended beyond a certain length. The bolts must be of iron, and the traces are generally let into the side of each flitch, to give a firmer abutment. The abutments should be of iron, bolted through the thickness of both pieces, and should have a broad part in the middle. Some resemble an inverted wedge at the bottom, and rise cylindrically to the top, where they are screwed and nutted.

In the article CONSTRUCTIVE CARPENTRY, *plates* II. to XXIII., which we have selected from the engravings in Nicholson's valuable work, the "New Carpenter's Guide," exhibit the best methods of performing the principal operations of Carpentry.

Plate II. illustrates the necessary lines of a roof, and exhibits a general method for the bevels of the purline. $a b$ is the width of the building, make b for $a e$ equal to half the width, and $c d =$ height of roof, then $d e$ or $d f$ will be the *length of the common rafters;* draw the diagonal $b c$, continue it to g, making $c g =$ height of roof, and join $g a$, which is the *length of the hip rafter*. Let the purline be at any place of a common rafter, as at l, from the point h, with any radius, describe a circle, draw $g l$ and $p n$ parallel to $f b$ tangents, to the circle in p and q, from s and r, the points where the two sides of the purline intersect the circle, draw two lines parallel to the former to cut the diagonal in m and k, draw $m n$ and $k l$ parallel to $a b$, and join $n i$, $k i$: G is the *down bevel*, F the *side bevel of the purline*, and B and C are bevels of the ends of the purline when it is placed level. By turning the stock of the bevel at F from a round the line $i z$, we shall have the *side bevel of the jack-rafter*; and the bevel at A, the top of the common rafter, is the *down bevel of the jack rafter.* For more information on this subject, see *Roof.*

Plates III. and IV. Construction of Domes. As the method of finding the centres to cover a dome horizontal, is found very troublesome in practice, owing to the centres running out to a great distance, the following more practical method is offered. To find the curve of the boards that are near the bottom, *fig.* A. *plate* III. divide one quarter of the circumference of the dome into equal parts, each equal to the width of a board, making proper allowance for the camber, at the centre m describe a small circle, equal to one of the divisions; from n with radius $n m$, describe an arc to touch the centre of the dome at m; and let H be the last board that you can conveniently describe with a centre, that is, the sixth board from the top; continue the inside curve of the board H round to f in the axis of the dome, and draw the line $f n$; also draw parallel lines from the points 1, 2, 3, 4, 5, 6, &c., to cut the axis of the dome in 2 b d, &c.: draw the line 1 p to touch the small circle in the centre, and divide the distance from p to 2, into two equal parts at q, and draw $q n$; then divide the arc from q to r into six equal parts, and from the centre at n, draw lines to a, c, e, &c., and from these points draw lines to 2, 3, 4, 5, &c., to the other quarter; then is the distance from 1 to 2 half the length of the bottom board which may be seen at B, (*pl.* IV.) set on each side of 2; and the small distance from 1 to q, in the axis, is its height; which is set from 2 to 2 for the height of B; and 2 *b* is half the length of the board C, and *b a* its height: also 3 *d* in *fig*. A, is half the length of the board D, and *d c* its height. The distance 1 1, or the length of B, may far exceed the length of any board that can be found, take therefore half its length, and ½ the height, for the length and height of B, so that the same sweep may come within the reach of a board: if this be still too large for a board, the length and height must be again diminished in the same proportion. The other boards, C, D, and E, are each one half of the lengths as taken from *fig*. A, and must, by the foregoing rule, only raise ½ their weight to have the same sweep.

Plate V. How to cover the whole of an ellipsoidal dome with one mound only, when its base or plan is a section, passing perpendicularly through the fixed axis, or any other section parallel to it. Let ABCD be a plan of the dome, which is a section through the quarter axis of a spheroid; let BD be the lesser axis; divide ½ of the plan BA into a convenient number of equal parts, as six; from these points draw lines, 1 *h a*, 2 *i b*, 3 *k c*, 4 *l d*, &c. parallel to the greater axis AC, cutting the lesser BC at the points *a*, *b*, *c*, *d*, *e*, from B make B*f*, equal to half of any of the equal distances, as between B and 1; draw *f x* to the centre, cutting 1 *a*, 2 *b*, 3 *c*, &c. at the points *h*, *i*, *k*, *l*, *m*; from the point B, in the line AC, at No. 1. (*pl.* IV.) stretch out the arc BA, of the quadrant at *fig*. 1, on the plan, as at 1, 2, 3, 4, &c.; through these points draw ordinates at right angles to AC, from the points 1, 2, 3, &c. in AC, (No. 1.) make the distances 1 *h*, 2 *i*, 3 *k*, &c. equal to their corresponding distances, B*f*, *a h*, *b i*, *c k*, &c. on the plan, which will give points through which the curve may be completed.

Plate VI. *Fig*. A is the plan of an elliptic dome, B the section in the length, and C the section in the breadth; *a a* in B, and *b b* in C, shew how to square the purlines, so that one side may be fair with the surface of the dome. The plan of the purline is formed by dotted lines drawn from the sections of the purline. To proportionate the curb at the top to meet the surface of the dome, draw the diagonals *i l*, *k m*, and let *h e* and *g f* be the width, then *g h* or *e f* will be the true length of the curve. To find the form of the *gores*, let the board required be that over *a b c* in the plan, divide the quadrant D of the ellipse into 3 parts, so that the chords *a b*, *b c*, *c d*, shall be equal, draw the lines *c a*, *c b*, *c c*, *c d*, to the centre: transfer the triangle *a b c* from D to *a b c* in G, and draw the line *c*-1-1-1-1, &c. in G at right angles to *a b*, and describe a rib G to the height of the dome, and the base to the perpendicular of the triangle *a b c*, divide the curve into five equal parts, and extend them along the line 1-1-1-1, &c. in H: from the points of division in the curve draw lines perpendicular to the line c-1-1-1, &c. to meet the sides *c b* and *c a* of the triangle, transfer the segments of these lines to H, and through the remote extremities draw the curves *b b*, *c d*, *e f*, *a*-1-2-3-4, which will form the edges of the gore over *a b c* on the plan. The other gores are found in the same manner.

Plate VII. exhibits the method of executing the ribs of a dome in two different ways. In one method the filling-up ribs are in planes, parallel to the sides of the principal ribs; in the other they are horizontal bars, and their sides are in planes tending to the centre of the dome. *Fig* 1 is the elevation, and *fig* 2 the plan. To find the centre of the parallel jack-ribs, suppose *b c* on the plan to be a jack-rib, continue it till it meet the opposite side in *d*, bisect *b d*, by a perpendicular *o a e*, at *a*, make *a o* = A O on the elevation, with radius *o b* describe the arc *b e*, which will be the curve required.

Plate VIII. Domes in Pendentives. *a b c d*, *fig*. A, is the opening of a square staircase, which is to be bracketed up into the circular curb of a skylight, which shows in the plan at A, and the section at B; every bracket is of the same sweep throughout, but cut shorter off the under end. To find the curve B on each side of the staircase, for the under ends of the brackets, so that it shall correspond in every height to the brackets: draw the lines *o* 1, 1 1, 2 1, 3 1, 4 1, at right angles to 1 1 1 1 1, the base of C, one of the brackets; from *e* describe arcs from these points to meet the base of B in the points, 1, 1, 1, &c. and from these points draw perpendiculars towards *o* 1 2 3 4, transfer the ordinates of C to those of B, which will give the curve or foot of the brackets. *Fig*. D is the plan for a semicircular domical finish, and E the section. This is a more elegant form than the other. To get the curve of the ribs, from the centre of *fig*. D, describe a circle to touch the angles of the staircase at *a b c d*, which will be the curve of every rib. To find the bottom ends of the ribs on each side, draw the semicircle E, to the opening of the staircase, and the curve will give the bottom of the ribs. To find the bottom of the ribs for a segment finish, let *f i g h c* be the circular arc of the curve of the ribs, draw the lines *a b* and *d c*, and produce them to cut it in *h* and *i*, then draw *i h*, and describe a segment of a circle upon *b c*, to touch *i h* in *k*, for the bottom of the ribs.

Plate IX. is a section of the dome of St. Paul's at London. See the article *Dome*.

Plate X. *Fg*. 1., a design for a domical roof, the bottom of which is made in a small compass, to gain room within the dome. *Fig*. 2 is a circular truss for a bridge, &c.

Plates XI. and XII. Scaffolding for Domes, &c. *Fig*. 1. shews the method of building a stone dome, No. 1. being the plan, and No. 2. the elevation. *Fig* 2. the method of joining the stone. *Fig*. 3. (*pl*. XII.) method of scaffolding a dome upon brackets, which may only be hung by making the end of the horizontal part pass into a hole of a small depth in the wall, No. 1. being the plan, No. 2. the elevation, No. 3. a section, and No. 4. (*plate* XI.) one of the brackets on a larger scale. *Fig*. 4. another method of scaffolding a dome, without any standards from below.

Plate XIII. Centering for brick groins. *a a a a a a* (*Fig*. A) plan of the piers supporting the vault, *a b* the end opening, which is a given semicircle, in this *b c* is the opening of the side arch, which is to come to the same height as the end arch *a b*, fix the centres over the body range, as shewn in the section at C, and board them over: in *fig*. A and C is shewn the manner of fixing the jack-ribs upon the boarding. To find the moulds for the jack-ribs, take the openings of the arches in *fig*. A, that is *a b*, *b c*, and place them in *fig*. D. making *a b c* a right angle, divide one half of the given semicircle E into 5 equal parts, and square them across 1, 1, 1, &c. to cut *d b* and *d c* in 2, 2, &c., and through these points draw lines parallel to 1, 1, 1, &c., the base of E both ways towards F and G; stick nails in the points 1, 2, 3, 4, 5, at E, and bend a thin slip of wood round them, and mark it opposite to every nail; then stretch the slip out from *d* to 5, marking the intermediate points 1, 2, 3, 4; lines drawn perpendicularly from these points, will intersect the other lines in small squares and the curve drawn through the diagonal will be the edge of the required mould. To fix the jack-ribs, bend the mould G from *d* to the crown at *e* in *fig*. A, the line G *d* drawn by the curved edge will give the line on the body range, where the upper edges of the boarding of the side vaults terminate; fix a temporary slip of wood in the direction *f f*, so that the upper surface may be level with the crown of the body range, the height of a jack-rib at any place, will be perpendicular from the under side of the slip to the surface of the boarding which covers the body range. To find the moulds to cut the ends of the boards, the rib F being traced from E, take the parts round it, and lay them from the centre of the groin on a perpendicular to *a b*, the base of the rib E from *d* to 5, marking the intermediate points 1, 2, 3, 4, and find the mould H in the same manner as G, and it will be the mould required. If both sides have the same opening, as in *fig*. I., take half the span of the arches as a radius, describe a quadrantal arc, which divide into six equal parts, stick nails in the points of division, bend a slip round, marking it at every nail, and extend one of the lines O 6, which forms the right angle, draw perpendiculars through the points of division in the arc to the other side of the right angle, extend the slip, and place the edge marked with the divisions upon the extended line from O to 6, mark the intermediate points 1, 2, 3, 4, 5, draw lines through these points perpendicular to the extended line, and trace the curve on the edge of the mould K. Further information on the subject of groins will be found under the article *Groin*.

Plate XIV. and XV. Glueing of niches, circular work, &c. *Fig*. 1, the method of glueing two boards together in one plain, No. 1. shewing the section, No. 2 their elevation: in No. 1 the joint is plain, and in No. 2, tongued. *Fig*. 3, the manner of joining one board to another at right angles, strengthened by a blocking. *Fig*. 4, two boards glued at an obtuse angle; No. 1, section, No. 2, elevation. *Fig*. 5, the method of glueing up an architrave, No. 1 section, and 2 elevation as finished, No. 3 and 4 before the mouldings are struck, No. 5 and 6 how they are put together when newly glued. *Fig*. 6, (*plate* XV.) the method of glueing up niches, and *Fig*. 7, of glueing up circular work in veneers.

Plate XVI. the plan and elevation of a dog-legged staircase, consisting of a progressive and retrogressive flight of steps, connected by winders.

Plate XVII. plan and elevation of a geometrical stair, with a half space between progressive and retrogressive steps.

Plate XVIII. plan and elevation of an elliptic stair.

Plate XIX. Handrailing: the method of glueing a rail in thickness. A *b* is the stretch-out of the greatest circle in B, and *a c* the height of steps; *d e* is the compass of the lesser circle, set in the middle between *a b* and *d f*, the height of the steps, the same with *a c*; therefore the triangle *a b c* is the pitch-board of the inside falling mould, and *b m o* at the bottom, and *i h c* at the top, are the pitch-boards of two common steps, which lines, when intersected, will give the under line of the inside falling mould. In the same manner dfe, with the two common steps kgf at the top, and eln at the bottom, will give the under line of the outside falling mould; the top lines are only drawn parallel to the under lines to the thickness of the rail. To apply the moulds to the plank, draw a line tp, touching the moulds so laid down in two plans, and as both moulds intersect each other at q, draw pq perpendicular to the top of the plank, at the same distance as pq is from the bottom ends of your moulds, and this line being squared across the edge, and from thence across the under side, then set the distance pq on both sides of the plank, from the same edge, and likewise square over tsr, at the distance pt on the plank, on both sides, then set the distance of r from t upon the upper side of the plank, and set the distance of st upon the under side, mark the point q upon both moulds, apply the outside falling mould to the top of your plank, making the point q to coincide with the same point q in the plank, and make the front of the falling mould to come to r, and with it, in this position, draw the upper face of the plank, and in like manner apply the inside falling mould, the point q coinciding as before, on the under side, with the front edge to s in the plank, and draw the under side, the plank when cut out, and twisted to these lines, will be the true form of the veneer; it must then be cut into veneers the other way in such thicknesses as to bend easily. *Fig.* C shews the method of laying down a string board of a chain.

Pl. XX. and XXI. Gluing up cylindrical, conical, and spherical surfaces. *Fig.* 1, method of forming a cylindric surface on one board, by grooving the boards across at equal distances: No. 1, the elevation, 2, the plan. *Fig.* 2, method of forming a conic surface by radial grooves. *Fig.* 3, (*Pl.* XXI.) the same for a sector of a conic surface less than the half cone. *Fig.* 4, method of forming the surface of a globe; No. 1 and 2, grooving of the board, 1 being the face, and 2 the edge; No. 3, the mould upon which the spherical boards are to be bent; No. 4, two boards joined together.

Pl. XXII. XXIII. Glueing up columns, bases, and capitals. *Fig.* 1. method of glueing up the shaft of a column; No. 1, a section at top, and 2 at bottom; ABC the mitre bevel, DEI the trying up bevel. *Fig.* 2. mode of glueing up the base of a column; No. 1, the plan, 2 the elevation. *Figs.* 3 and 4, (*Pl.* XXIII.) Glueing up the Ionic and Corinthian capitals; No. 1, the plan, and 2, the elevation.

Further remarks will be found under the different articles, as *Dome*, *Groin*, *Hand-railing*, *&c.*

Contact, (*contactus*, Lat.) in Geometry, is when a line or plane touches a figure, and may be produced either way without cutting it.

Content, (*contentus*, Lat.) in geometry, the area, or quantity of matter or space included in certain bounds.

Contexture, (*contextus*, Lat.) the disposition of the constituent parts of a body in respect to each other.

Contignatis, (Lat.) in Roman carpentry, was what is now termed naked-flooring.

Contiguity, (*contiguus*, Lat.) the situation in which two bodies or surfaces meet.

Continued, a term applied to any thing that is not interrupted. An *attic* is *continued* when it is not broken into pilasters; a *pedestal* is *continued* when its mouldings and *dado*, or *die*, are continued without interruption through the column and intercolumniation.

Contorted, wreathed.

Contour, (*Contorno*, Ital.) the outline of a body.

Contramure, in Fortification, an external wall built to protect and strengthen the wall it faces or incloses.

Contrary Flexure, point of, the meeting of two curves, which bear the convexity of one, and the concavity of the other, on the same side of the line.

Contravallation, in Fortification, a trench guarded by a parapet, beyond musket-shot from a besieged place, raised for the defence of the besiegers.

Convent, (*conventus*, Lat. an assembly,) a religious house.

Conventual Church, one belonging to a convent.

Convergent Lines, lines which would meet if produced.

Convex, (*convexus*, Lat.) swelling externally in a circular form. A *convex rectilinear surface*, is a curved surface, in which a point being taken, a right line passing through it can be drawn only in one direction.

Convolution, (Lat.) a winding motion.

Co-ordinate, (from *con* with, and *ordinatus*, Lat.) holding the same rank or proportion. *Coordinate* pillars stand in equal order.

Coping, (from *cop*, Dutch, the *head*,) the upper tier of masonry which covers a wall. When it is of an equal thickness, which is done only on inclined surfaces, or on a wall that is intended to be covered by a roof, it is called *parallel coping*. When thinner on one edge than the other, it is called *feather-edged coping*. When thick in the middle, and thin at each edge, it is called *saddle-backed coping*. In Gothic architecture, the coping is either inclined upon the faces or plumb: in the former case the sides of the vertical section are those of an equilateral triangle, with its base horizontal. It is sometimes in one inclined plane, terminated at the top by an astragal, and at others in two inclined planes parallel to each other; the upper terminated at top with an astragal, and projecting before the lower, which, like that on one inclined plane, changes its direction at the bottom into a narrow vertical plane, which projects with a level soffit before the parapet. Inclined coping is sometimes without the astragal. The soffit of a projecture is said to *cope over* when it slants downwards from the wall.

Corbeils, (*corbis*, Lat. a basket,) sculptured baskets of flowers or fruit, sometimes placed on the heads of caryatides. In Fortification, *corbeils* are little baskets of earth set upon the parapets, to shelter the men in firing on the besiegers.

Corbels, in castellated and Gothic edifices, a row of stones projecting from the wall to support the parapet, serving in the place of brackets or modillions. The term is applied also to a horizontal row of stones and timber in a wall or vault, to sustain the floor or roof; to the vase of the Corinthian capital, which in form resembles a basket; and by some to a niche in a wall, to contain a statue.

Corbel-Table, a series of semicircular arches which cut one another in a wall, supported by timbers with their ends projecting out, and carved into heads, faces, lions' heads, &c.

Corbettis, a word which Chaucer uses, to signify stones that support images.

Cores, a Spanish term for architectural ornaments.

Cordon, the edge of a stone at the outside of an edifice.

Core, the interior of a wall, &c.

Corinth. The city of Corinth was proverbial for its wealth as early as the time of Homer. It is celebrated in the history of architecture, for the invention of one of the orders: but it is remarkable that no remains can now be found at Corinth of any edifice of the Corinthian order; nor could Mr. Dodwell perceive, in any part of the isthmus, the acanthus plant, which forms its distinctive capital. The Acrocorinthus, or Acropolis, is one of the finest objects in Greece, in a commanding situation on a precipitous rock. Corinth now preserves few monuments of antiquity. At the south-west corner of the town, eleven Doric columns supporting their architraves, were seen by Chandler; but when Dr. Clarke visited Corinth, only seven remained standing, and only five of them supported an entablature. Mr. Dodwell observes, that this temple "is probably the most ancient remaining in Greece, if we may judge by its massive and inelegant proportions. The columns are each composed of one block of calcareous stone, which being of a porous quality, was anciently covered with stucco of great hardness and durability. A similar expedient has been practised in all the temples of Greece, Sicily, and Italy, when the columns are of common stone." Their height, instead of being equal to six diameters, the true proportion of the Doric shaft according to Pliny, does not amount to four. They are fluted.—Dr. Clarke found the ruins of some ancient buildings, particularly of one partly hewn in the rock, opposite the temple. The outside exhibited the marks of cramps for sustaining slabs of marble, once used in covering the walls, a manner of building which does not appear to be earlier than the time of the Romans. Close to the Bazaar he saw part of a very large structure, built entirely of tiles or thin bricks. The people of the place remembered its being more perfect, and described it as full of seats, ranged one above another. Perhaps, he thinks, it might have been the Odeon.

Corinthian Order. An account of the origin of the Corinthian capital has been given under the article Capital. The earliest mention of the Corinthian order is by Pausanias, (lib. viii.) who informs us, that it was used by Scopas in rebuilding the temple of Minerva at Tegæa, in Arcadia, in the fourth century before Christ. It is very seldom found in buildings anterior to the Roman emperors, when it was universally made use of. Among the ruins of Balbec and Palmyra it is almost the only order to be found. The only difference in symmetry between the Corinthian and Ionic columns, lies, according to Vitruvius, in the height of their capitals, the latter being only one-third, and the former the whole of a diameter. The Corinthian abacus is in height one-seventh of a diameter, and its diagonal two diameters: it has concave faces, moulded on the fronts. We are led to suppose, from the silence of Vitrurius on the subject, that each pair of the four faces of the abacus were continued till they met in an acute angle at each corner: examples are found in the temple of Vesta at Rome, and in the Stoa or Portico at Athens. The lower part of the capital consists of two rows of leaves, each row containing eight plants. One of the upper leaves fronts each side of the abacus, and the stalk of each leaf rises between each two lower leaves. The two rows of leaves, and the caulicoli and volutes are each two-sevenths of a diameter. The breadth of the bottom of the capital is one diameter. From Vitruvius (lib. iv. c. 1.) we learn, that in his time, the Corinthian column supported either a Doric or Ionic entablature. Examples of such a use of the Ionic entablature are found in the temple of Vesta near Tivoli, in that of Antoninus and Faustina, and in the portico of Septimus Severus at Rome. In the arch of Adrian at Athens, and in the temple at Jackly, near Mylassa. Of the use of the Doric entablature with the Corinthian column, we know of no example. But the Corinthian column is generally found with a peculiar entablature of its own, in which are introduced the architrave, frieze, cymatium, and denticulated band of the Ionic, surmounted by the mutules of the Doric, which latter are converted into a console, the ends and sides of each being shewn, and the bottom covered with a foliated leaf. The superior members of the cornice resemble the Ionic. In some examples of the Corinthian cornice, modillions of two plain faces are used in the place of consoles. In one example, the second cornice of the Tower of the Winds, at Athens, dentils are used above the modillions. When the entablature is enriched, the shaft is generally fluted, its flutes being in number twenty-four.

Cornice, (*coronis*, Lat. *corniche*, Fr.) the upper part of the entablature. The richest cornice is the Corinthian, being the fullest of members, and the most graceful in its proportions. The Ionic cornice is of graver proportions, and is destitute of modillions, and often of dentils. The Doric is lower in its proportions, has a greater projection, and is distinguished by its cymatium, mutules, and drops. See under the different Orders. When the cornice rests upon the architrave, as in the Caryatic Portico at Athens, it is termed an *architrave cornice*. In a *block cornice*, the corona is supported by plain rectangular prisms, with level soffits instead of mutules. *Coved cornices*, which are often found on old houses, have a large cove, and are generally lathed and plastered on brackets. In a *mutilated cornice*, some of its members are interrupted by another object. See *Stucco*.

Corona, (Lat. χορωνος, Gr.) the brow of the cornice, which projects over the bed mouldings, to throw off the water, forming a division between the cymatium and crown members, and the lower division of the cornice. In Grecian works the corona is never omitted. The principal examples of its omission by the Roman architects are found in the Temple of Peace at Rome, the third order of the Colosseum, and the arch of Lyons at Verona. In the arch of Constantine, the corona, surmounted only by a fillet, finishes the cornice.

Corostrota, a name applied anciently to a kind of inlaid work.

Corps, a French term applied to the projecting part of a wall, which is intended to form a ground for decoration.

Corridor, (*corridore*, Ital.) a long gallery or passage in a mansion, connecting various apartments, and sometimes running round a quadrangle.

Corsa. See *Platband*.

Cortile, (Ital.) the court-yard of

Italian dwelling-houses, often embellished with columns and statues. It answers to the Roman cavædium.

CORTINALE, (Lat.) among the ancients, the apartment which contained the cortina, or three-footed stools, from whence the Pythians delivered the oracles of Apollo.

COSSUTIUS, a Roman, and one of the architects of the temple of Jupiter Olympius at Athens.

COTTAGES, (*cot*, Saxon,) small houses or habitations, the humble dwellings of the poor. They are of various descriptions, from the rude straw-thatched, mud-walled hovel, to the neat and comfortable dwellings erected for the accommodation of the labouring peasantry, near the pleasure-grounds of country gentlemen.

The vicinity of Downton Castle, surrounded by every interesting object of rural nature, is enlivened by numerous cottages, and small dwelling-houses of neat and comfortable appearance; and its late accomplished proprietor has, in his poem of the "Landscape," given the character of these valuable appendages to elegant landscape scenery. A neat garden, well stocked with fruit trees, should surround the country cottage, which must consist of two or more apartments, according to the number of the inmates.

Mr. Thomas Dearn, of Cranbrook, in Kent, has communicated some useful hints on this subject, in a letter inserted in the 24th vol. of the Repertory of Arts and Manufactures. His objections against the generality of cottages for the labouring poor, are these:—That being of either lath-and-plaster work, or their walls composed of bricks of not more than four inches in thickness, and *rough-cast*, or *rendered*; in the first instance, proving a weak defence against the weather; and in the latter, subject to injury from the slightest causes, and also liable to dampness. To give stability and warmth, and at the same time save materials, Mr. Dearn proposes to lay the foundation course, and the two following courses of the walls, in the usual old English manner, with alternate courses of *headers* and *stretchers*; and from this foundation the wall is to be raised to the required height by alternate courses of *stretchers* on edge, on the back and front of the wall; and *heading* courses to cover, leaving a vacant space between the *stretchers* of the width of half a brick. Bond timbers may be introduced as may be deemed necessary. It is stated, that by this mode a saving of one-third, in the article of bricks, will be effected; that only one half the quantity of mortar will be used; that less labour will be required; and that the walls will, by this mode, be entirely free from damp; and the expense at least less by one-fourth than the less eligible mode of lath-and-plaster building. See *Pisay*, *Villa*, and *Rural Architecture*.

COVE, a concavity. The term *cove bracketing* is generally applied to that of the quadrantal cove.

COVED AND FLAT CEILING, a ceiling in which the section is the quadrant of a circle, rising from the walls, and intersecting in a flat surface.

COVER, that part of a slate which is hidden or covered.

COVER WAY, the recess left in brick-work for the reception of the roofing.

COVERT WAY, or *Corridor*, a level space of about twenty feet broad, from the edge of the ditch, surrounding half-moons, or other fortifications: it has usually a parapet, with pallisades down the middle, and a foot-bank It is also undermined on all sides, so that to make a lodgment upon it is difficult. The extreme edge toward the fortress being the talus that supports the earth of the covert way, is called the counterscarp; but when the enemy is said to have made a lodgment in the counterscarp, it is understood to include the whole of the covert way, with its parapet and glacis.

Coving, in old buildings, the projection of the upper stories of houses over the lower. The *covings* of a fireplace are the inclined vertical parts on the sides.

Couch, a layer, or coating.

Counter, a name given to the superintendent of a canal, or other great work, under the resident engineer.

Counter Drain, a channel dug parallel to a canal, &c. for the conveyance of the soccage water, by means of drains, into the lower grounds.

Counter Fort, a pier or buttress to strengthen a wall.

Counter Gauge, a method of measuring joints in carpentry, by transferring.

Counter Lath, one placed between every couple of gauged ones.

Counter Parts, the similar equal wings of a building.

Countersink, to make a cavity in timber-work for the reception of a plate of iron, or the head of a screw or bolt.

Counter-Swallow's-Tail, in Fortification, is an out-work in form of a single tenaille, wider at the gorge toward the place, than at the head toward the country.

Country House. See *Villa.*

Coupled Columns, columns arranged in pairs.

Couples, a term used in the North, for rafters framed together in pairs, with a tie fixed above their feet. The *main couples* answer to the *trusses*.

Course, a continued layer of bricks or stones in building. The term is also applied to a row of slates or tiles, arranged with their lower ends level. The *course* of the face of an arch is the arch-stones, which have their joints radiating to the centre. The *course* of a plinth is its continuity in the face of the wall. A *bond course* is farther inserted into the wall than those adjacent. The joint between two courses is called the *coursing joint.*

Court, (*Cour*, Fr.) an open area before or behind a house, or in the centre, between the body of the building and the wings, answering to the Roman cavadium. Courts admit of the most elegant ornaments, such as arcades, &c. The courts of most of the houses in Pompeii were paved in compartments with marble, or in mosaic. See *Cavædium.*

Cousinet, or **Cushion**, the stone which is placed on the impost of a pier, to receive the first stone of the arch. The name is also given to the part of the front of an Ionic capital between the abacus and echinus.

Crab, an instrument to raise large stones.

Cradle, the same as *Coffer*, which see. The name is sometimes given to a centering of ribs and lattice, for turning culverts.

Cradling, timberwork for sustaining the lath-and-plaster of vaulted ceilings, or for sustaining the entablature for a shop front, &c.

Cramp, (*Kramp*, Dutch.) a piece of iron, bronze, or other metal, bent at each end, and used to hold together stones in buildings, and limbs of statues. Frequent use was made of cramps, which were generally of bronze, in the buildings of the Romans.

Crampoons, hooked pieces of iron for drawing up timber or stones.

Crane, (*cran*. Saxon,) a machine for raising heavy weights. This machine, as used by the Romans, is termed by Vitruvius *carchesium*.

Crapaudine Doors, are such as turn on pivots at the top and bottom.

Crenelle, in Gothic architecture, the opening of an embattled parapet.

Crescent, a building erected in the form of an arc.

Crest Tile, the tile on the ridge of a house. In Gothic architecture, leaves running up the sides of a gable, or ornamented canopy.

Creux, (French) that species of sculpture, in which the lines and figures are cut below the surface.

Crocket.(*croc*, French, a hook.) The small buds or bunches of foliage, used, in Gothic architecture, to ornament spires, canopies, pinnacles, &c.; the larger bunches at the top being termed *finials*. See *Gothic Architecture*.

Croissante Croix, a crescent, at each end.

Cromlechs, are rude erections, of great antiquity, found in many parts of Britain, particularly in Cornwall, Devonshire, and Wales: these relics are generally believed to be British, and though it has been contested that many circumstances seem to indicate a Danish origin, yet their being found in the hidden recesses of the Welsh mountains, where the Danes never penetrated, is sufficient to negative this opinion. The Cromlech consists of upright stones, supporting a larger one, placed nearly in an horizontal position. That these monuments of antiquity were connected with funeral solemnities, is probable; yet their frequent occurrence near Druidical remains, gives plausibility to the opinion, that they have been erected for sacrificial altars, or for some purpose connected with the ceremonials of that ancient order of priesthood.

Cronaca, Simone, an architect of Florence, born in 1454. After having visited the principal cities of Italy, for the purpose of taking accurate measurements of their ancient buildings, he returned to his native city, and rose to reputation. He finished the Palazzo Strozzi, which had been begun by Benedetto de Maiano, and built the sacristy of the church of Santo Spirito, and the church of S. Francesco del Offervanza at S. Miniato in the suburbs. His death happened in 1509.

Crosettes, the same as *Ancones*.

Cross, (*croix*, Fr. *crux*, Latin.) Ancient crosses, though generally classed among Christian antiquities are in some instances the remnants of heathen superstition; and not only may their existence in the British isles be traced to a period considerably antecedent to the introduction of Christianity, but, according to Borlase, many persons "continued to worship these stones as pagan idols; to pay their vows, and present their offerings, at the places where they were erected, coming thither with lighted torches, and praying for safety and succour."—This custom we can trace through the fifth and sixth centuries, even into the seventh, as appears from the prohibitions of several councils. In Ireland, some of these stones have crosses cut on them, which are supposed to have been done by Christians, out of compliance with the Druid prejudices; that when Druidism fell before the Gospel, the common people, who were not easily to be got off from their superstitious reverence for these stones, might pay a less censurable kind of homage to them, when thus appropriated as Christian memorials, by the sign of the cross. There is yet some remnant of the veneration paid to such stones in the British western isles, even by Christians. They call them *bowing stones*, from the reverence shewn them. It is remarkable that *Even Maschith*, which the Jews were forbid to worship, signifies a bowing stone, and undoubtedly was so called, because worshipped by the Canaanites. In the isle of Barray there is a stone, about seven feet high; and when the inhabitants come near it, they take a religious turn round it, according to the ancient Druid custom.

It is not easy to persuade the illiterate to relinquish an ancient religious custom: for in proportion as the mind is uninformed, the man is obstinate. Representations of the cross were first cut on the tops of single upright stones; afterwards the shaft was variously ornamented with carvings. These crosses appear to to have been erected for various purposes, as marking the boundaries of districts—places of sanctuary—sepulchral mementos—memorials of battles, murders, and fatal events—places of public prayer and proclamation:—some were also placed by the road-side, in church-yards, in market places, at the junction of three or four streets or roads, and on the spot where the bearers of a deceased person of eminence halted on the way to interment. It was commonly the practice of mendicants to place themselves by the side of these, and beg alms in the name of Jesus. In the Archæologia there is an authentic instrument, dated the twenty-fifth of November 1449; wherein it is stated, that in the church-yard of St. Mary Magdalen, in Milk-street, London, on the west side of that street, stood a cross of the height of a man or more; and that the same *cross was worshipped by the parishers there, as crosses be commonly worshipped in other chirche-yardes.*

Crosses were erected by many Christian kings, before a battle, or great enterprise. Oswald caused a cross of wood to be erected, before he fought with Cadwallo, himself holding it till the earth was rammed in round about it, while all his soldiers kneeled down devoutly.

The stone at Frisby, called *stump cross*, is a boundary stone; and a second of the same kind, and also called the *stump cross*, stands on the top of a hill in the township of Cliverger, in the parish of Whalley, in the county of Lancaster; it is at present about five feet high. Several others of this kind might be mentioned.

Magdrum Cross, in Fifeshire, according to tradition, was dedicated to a celebrated saint named Magrin. It was a boundary stone and a sanctuary, and near it there is a carn, and an obelisk of rough stones; which is called Magrin's seat.

There are some singular and curious monumental crosses, in Penrith church-yard, in Cumberland. Two circular shafts mortised into pedestals, are situated about fifteen feet from each other, at what appears to be the ends of a grave. They are about eleven feet high, and have at the top of each a cross in relief; the shafts are also ornamented with fretwork.

There is a sculptured cross in the church-yard of Glamis in Scotland, supposed to have been erected in memory of the assassination of king

Malcolm, and is called his grave-stone: on one front is a cross; the figure of some wild beast, on the upper part, and on the other a centaur; and beneath, the head of a wolf, denoting the barbarity of the conspirators.

The remarkable stone cross in the church-yard of *Beaucastle*, Cumberland, is a square column, curiously ornamented, but its origin is unknown, and the same may be said of numerous similar erections in Wales, Scotland, and the north of England: by some they are attributed to the Danes; others are of opinion that they were erected by the Britons.

Numerous crosses of a similar character are found in Ireland, and a singular one at Kilcullen in the county of Kildare, which is ornamented with sculptured representations of ecclesiastics, with bonnets, tunics, and trowsers, and beards of a singular form. There is a very elegant cross in the county of Louth called St. *Boyn's Cross*; about eighteen feet high, on all sides full of sculpture. It is said to have been sent from Rome, erected by order of the pope, and to be of one stone. Near the centre is a representation of Christ, and on the opposite side the figure of St. Patrick, and at the bottom the representation of Adam and Eve.

Nevil's cross near Durham is a memorial of the partial defeat of David Bruce by the ecclesiastical army, under the command of two archbishops, three suffragans, and other dignitaries of the church. The cross at Blore Heath in Staffordshire, Mortimer's Cross in Herefordshire, that called Camus' Cross in Scotland near Dundee, and numerous other crosses, are to commemorate battles. Crosses are very abundant in Cornwall; they are generally formed of a single shaft of granite, or moorstone, little if at all ornamented, and in many instances have been converted into gate-posts. At *Carnaton* Down in this county, there is a plain cross, apparently of great antiquity, which being only a short distance from the site of the Druidical temple called the *Hurlers*, is supposed by Mr. Britton, to have been of Druidical origin, and converted into a Christian symbol by the first missionaries to this remote part of the island.

The most ancient monumental erections are believed to have been crosses of a pyramidal form, and numerous remains of these are yet found in various countries, sometimes to preserve the remembrance of a single person, sometimes that of many on some singular occasion. Malmsbury mentions two in the cemetery of the monastery at Glastonbury, in his time ancient and ruinous: the tallest was 26 feet high, and had five ranges of statues of British and Saxon bishops, kings, and ecclesiastics. The other was 18 feet high, with four similar ranges of sculptures. The monument of St. Dunstan at Canterbury was a tall pyramid; and at Ruthwell, in Scotland, are three pieces of an ancient and curious monument of this kind, overturned and broken by order of the General Assembly in 1644. Godric, abbot of Peterborough, erected a cross of stone in the churchyard where the monks were buried, who fell in a conflict with the Danes, in 870, that passengers might pray for the souls of the faithful resting there.

Preaching crosses, or stone pulpits, in church yards, do not appear to have been numerous: they were sometimes placed contiguous to monasteries; of which the cross of the black friars, or friars preachers, at Hereford, is an instance; its form is hexagonal, open on each side and ascended by steps. The top of the pulpit is embattled, and the whole finished in a style of great elegance.

The octangular building at Shrewsbury, near the abbey, called *St. Winifred's Pulpit*, is a handsome building, in the Gothic style, and esteemed a masterpiece of its kind; it is in a great degree similar to that at Hereford.

St. Paul's cross, in London, stood nearly in the middle of the churchyard of the cathedral church of that name, and was standing when Dugdale wrote his history: it was the most celebrated erection of this kind in England; and Stow informs us, that it was "of timber covered with lead, mounted upon steps of stone, the very antiquity thereof unknown; but, (he continues) I read, that in the year 1259 king Henry III. commanded a general assembly to be made at the cross, and that the mayor and aldermen should cause to be sworn before them, every stripling of twelve years of age, or upwards, to be true to the king and his heirs, kings of England. Also in 1262, the same king caused to be read, at St. Paul's cross, the bull of Pope Urban IV. Also, in the year 1299, the dean of St. Paul's cursed, at St. Paul's cross, all those who had searched in the church of St. Martin's-in-the-Fields, for a hoard of gold."

There was another public preaching cross in Spitalfields, which was destroyed by an infuriated mob at the time of the Reformation.

Market crosses are of various forms, and originated in the double purpose of inculcating the established religion, and the encouragement of the commerce of the town or district in which they were placed. These erections probably at first consisted of single shafts, surmounted by a cross: they were afterwards made of greater proportions, and arched over like those at Cheddar, Malmsbury, and other places; or "with intent to excite public homage to the religion of Christ crucified, and to inspire men with a sense of morality and piety amidst the ordinary transactions of life;" they were raised high, and decorated with pinnacles, niches, and statues, like those at Winchester, Bristol, and other places.

The White Friar's cross at Hereford, Coventry cross in Warwickshire, Gloucester cross, and that at Cheddar in Somersetshire, are of this description. Also, that of Malmsbury, described by Leland as "a right fair and costly peace of worke, made all of stone, curiously voulted for poore market folkes to stand dry when rayne cummeth. There be 8 great pillars, and 8 open arches; and the worke is 8 square. One great pillar in the middle beareth up the voulte. The men of the toune made this peace of work *in* hominum memoria." But the most beautiful erection of this kind is that at Stourhead, originally erected at the junction of four streets in the city of Bristol, and called the High Cross. It was built in 1373, by voluntary contributions, and intended to perpetuate the memory of king Edward the Third, who, about that time, had granted the first charter to the city. It was several times removed from the place it originally occupied, and at last presented by Dean Barton to Mr. Hoare, of Stourhead, who expended about £300 in its removal, and re-erection in the delightful gardens at that place.

The most beautiful erections, denominated Crosses of Memorial, are those built by king Edward the First, at the places where the body of queen Eleanor rested. Respecting the place of this queen's death, and the different stations at which the funeral procession halted, historians are not entirely agreed; but the general belief is, that she died at *Hereby*, in Nottinghamshire, in November, 1290. Of the memorial crosses that remain, the most beautiful are, that at Geddington, of a triangular form, its three faces divided into six panels each, and profusely ornamented with elegant sculptures: the second, near Northampton, which is in the most perfect state, is octagonal, approached by eight steps, and placed in an open country; the lowest of its three stories has eight faces, separated by buttresses, each face having a pointed arch, with a central mullion and tracery, and crowned with a purfled pediment: and the third, at Waltham, has originally been the most richly ornamented, and of a more elegant construction than either of the former, but it is in a more ruinous condition. It has six faces.

Formerly crosses, of various kinds, were very numerous in this country. Pennant mentions 360 in the island of Iona, all of which were destroyed by the indiscriminate fury of the religious fanatics at the time of the Reformation. The original purposes of these erections, it cannot be doubted, were good, and in many instances intended to preserve the remembrance of important events, and as the grateful memorials of pious and benevolent bequests of distinguished individuals, who wished to live in the grateful recollections of succeeding generations; of this description the memorial cross of the celebrated painter Martin Hemskerck, is a pleasing instance. As a memorial expressive of pious gratitude to Providence for the riches which he had been allowed to accumulate by his industry, and to perpetuate a grateful remembrance of himself in the breasts of posterity, he ordered that a copper monumental cross should be erected as a deed of settlement of a certain sum of money, to be paid annually, as a marriage dowry to a young woman of the village. At a succeeding period, religious feuds arose, and all the crosses of the district were demolished, except this of the benevolent painter, where, to this day, agreeable to the express conditions of the testament, the village maidens, every returning year, dance around the grave of Hemskerck. — *Britton's Architectural Antiquities.*

Cross-banded, a term applied to a veneer on a hand-rail, the grain of which crosses that of the rail.

Cross-Beam, a large beam going from wall to wall; or a girder that holds the sides of the house together.

Cross-Vaulting, a common name given to *groins* and *cylindric vaults*.

Crow, an iron bar used by masons and bricklayers.

Crown, (*corona*, Lat.) the upper part of a cornice, including the corona. The ornaments on the keystone of an arch, called also a console. In geometry, the term *crown* is given to a plane ring, whose surface is contained between the circumferences of two concentric circles. *A crown post*, called also *king post*, or *joggle post*, is the truss post that sustains the immediate bearing of the principal rafters of a roof. See *Abacot*.

Crypt, (Latin,) a subterranean vault, generally beneath ecclesiastical edifices. It is not improbable that crypts originated in the secret places of meeting amongst the early Christians, who were hindered by their persecutors from public worship. It is remarkable that Richard, prior of Hexham, calls the crypts of the ancient Anglo-Saxon churches, "chapels and oratories subterraneous," from which it is evident that they were not used for sepulchres. It has been conjectured that they were often used for sanctuaries. They were often adorned in the richest style of architecture. It was not until later times that they were used for places of burial, perhaps in imitation of *catacombs.*

Crypt Porticus, subterranean or dark passages and galleries in the Roman villas, often used as cool sitting rooms. In Pliny's villa at Laurentium, the crypt porticus had windows on each side, looking towards the sea, and the gardens, which might be shut in cold weather.

Cube, (*κυβος*, Gr. a die,) a solid of six equal square sides.

Cubiculum, (Lat.) a chamber. Pliny makes a distinction between the *cubiculum* and the *dormitorium.* The name was given also to the royal pavilion or tent, which was built in the circus or amphitheatre, for the reception of the emperors.

Cubit, (*cubitus*, Lat.) an ancient measure, equivalent to 1 foot 5.952 inch English, or about a foot and a half. According to Vitruvius, the geometrical cubit equalled six common cubits.

Cul-de-Four, a French term applied to a kind of low spherical vault.

Culmen, of the Romans, was the ridge-piece of the roof.

Culvert, an arched drain for the conveyance of water under canals or roads, or for discharging the rain water from hollows on the upper side of a canal.

Cunette, or *Cuvette*, a deep trench, four fathom wide, in the middle of a dry moat, to obstruct the enemy's approach to a fortified place.

Cuneus, (Lat. a wedge) that part of the Roman theatre where the spectators sat.

Cupola, (It.) a dome. See *Dome.*

Curb, a noosing of oak for brick steps, to prevent the bricks from being dislocated.

Curb Plate, the wall-plate of a circular or elliptically ribbed dome also the horizontal rib at top, and the circular frame of a well, or the plate of a skylight, are thus denominated.

Curb Roof, or *Mansard roof*, a roof formed of four contiguous plains, each two having an external inclination. Its principal advantage over the other roofing, is, the giving more space to the upper rooms of the house. Curb roofs have generally dormer windows on the lower side. The upper rafters on both sides are called the *curb rafters*; and the horizontal piece of timber, at the junction of the upper and lower rafters, the *curb plate.* In the plates, *curb roof*, *fig.* A is a curb roof with a door in the middle of the partition, in which the beam *a b* must run quite across, the pole plate must be tenoned into the beam at *a* and *b*, and the story post *a c* and *b d* be let into the beam with a small tenon, as it should project about an inch on each side of the beam. *Fig.* B is a roof calculated for two rooms in breadth. The other plate represents the curb or mansard roof, as executed in Paris.

Curator, (Lat.) the name given to the Roman surveyors or inspectors of public works.

Curia, (*κυρια*, Gr.) the Roman council house. There were several curiæ in the city and empire. The *curia municipalis*, or *domus curialis* appears from Vitruvius to have resembled our Guildhall. The *curia dominicalis* was a court, or manor house.

Cursor, (Lat.) the point of a beam compass which slides up and down; the part of a proportional compass, by which the points are set to any given ratio; the sliding parts of ellipsographs, &c.

Curtail Step, the first step in a stair, which is generally finished in form of a scroll.

Curtain, (*cortina*, Lat,) that part of the wall of a fortification, or rampart, which lies between two bastions.

Curve, (*curvus*, Lat.) a line that may be cut by a straight line in more points than one.

Curvilinear, (*curvus*, curved, *linea*, line, Lat.) bounded by curved lines.

Cusp, (*cuspis*, Lat.) a term applied by Sir James Hall, in his essay on the origin of Gothic architecture, to the pendents in the Gothic style. Assembled, they form trefoils, quatrefoils, &c.

Custom-House, a public building for the collection of duties and customs upon imported or exported goods. The finest buildings of this kind are that of Dublin, designed by Mr. Gandon, that of Bologna, by Dominico Tibaldi, and that at London, by Mr. Laing.

Cut, a canal. *Brackets* are *cut* when they are moulded on the edge. A *cut roof* is a truncated one.

Cutty Stool, in the Scottish kirks, a small gallery near the roof, painted black, in which the offenders against chastity are obliged to sit during the performance of the service, for three Sundays; subjected to the rebukes of the minister, and obliged to profess repentance.

Cuviller, Francois, a French architect, born at Soissons in 1698. He died in 1760. He was for some time in the employ of the elector of Munich. Many plans and designs which he left behind him, were afterwards published by his son, *Francois Cuviller*, who succeeded his father as architect at Munich.

Cyclograph, (*κυκλος*, a circle, *γραφω*, I describe, Gr.) an instrument to describe the arc of a circle to a chord or versed sine.

Cycloid, (*κυκλοειδης*, Gr.) the curve formed by a point taken in the circumference of a circle, whilst the circle revolves in a right line.

Cyclopean Buildings are the most ancient specimens of masonry; the character of which is "immense blocks of stone piled upon each other, and constituting walls without cement." Mr. Hamilton divides the specimens of this mode of building into four æras.

Specimens of the first are seen at Tiryns, and at Mycenæ, and consist of blocks of various sizes, which have, or have had, smaller stones in their interstices.

At Julis and Delphi, a second kind is seen, distinguished by the use of polygonal stones, exactly fitted into each other. In this mode there are no courses.

Specimens of the third kind are exhibited in Bœotia, Argolis, and the Phocian cities, distinguished by being worked in courses: the stones are of unequal size, but all of the same height.

The masonry of the fourth, and latest sort, is of stones of various heights, and always rectangular. Specimens of this description are found in Attica.

Among learned archæologists it is a prevalent opinion, that the Titan Celtæ were of the same race as the Cyclops, who built the citadel of Tiryns; and these Celtæ, or Cyclops, are said, by Pliny, to have been the inventors of the fortifications of towns, the first improvement upon earthworks, in military architecture; of which, according to Sir William Gell, and other writers, Tiryns remains the oldest and most perfect specimen. Homer calls it *Τιρυνθα τειχιοεσσαν*.

Towns were originally fortresses, to which the rustics fled for protection when the enemy invaded the country, bringing with them their flocks and herds, which were either driven within the walls, or occupied the vallum, which soon began to form an appendage to these military works.

The lions over the gate of Mycenæ, are the only known specimens of the sculpture of the heroic ages. The heads of these figures are wanting. They are placed in the rampant position; their hind feet on the architrave of the gate, and their fore-paws resting upon a short column, rising from the centre of the architrave, and supporting another column, the shaft of which tapers from the base, which is a double torus; the echinus of its capital is ornamented with three annulets, considerably distant from each other. The abacus is of the Doric order, above which four balls or circles support a second abacus. They are supposed to have been derived from the worship of Mithras, the lion being the symbol. Balls, and the spiral pillars, which, in all hieroglyphics, signify water, are found in the treasury of Atreus, at Micenæ, and at Persepolis. The triangular form of the stone above the doors at Mycenæ had a particular signification: it was a mysterious figure among the Egyptians. Diodorus informs us, that Cambyses, who lived in the sixth century before Christ, not only took ornaments, but even artists, from Egypt, to adorn his palace at Persepolis; and it is ascertained that these came from Thebes, which, by the Egyptians, was called the City of the Sun. The Cyclops worshipped fire, Vulcan, and the sun; and it is supposed that the lion might be the national symbol; but according to Dr. Clarke, the figures understood to represent lions, were in reality panthers or tigers, which were the more appropriate emblems of the mythology of these people, among whom these symbols formed the *hiera* at the gates of holy places, before which the people worshipped: there also the courts of justice were held; on which account it was necessary that there should be an open paved court in front of the propyleia. The gate at Mycenæ is strikingly illustrative of this account, and of numerous passages of scripture. See *Ezek.* xlvi. 1, 2, 3, &c.

The markets were also held in those places, and hence the vicinity to each other, of the forum, the senate-house, and the basilica. Stewart observes of the temple at Corinth, that the shafts of the columns are of one block, and that the diminution begins from the bottom: and this diminution, and an abacus of the Doric order, occurring in this column between the lions, leads to the belief, that though the pattern might originate in Egypt, yet that the Doric order arising from it might also be the first advance in Greece from Cyclopean rudeness to ornamented workmanship; this pillar being the first known Greek Doric pattern, to which, as far as is known, succeeded that at Corinth. It is not doubted that the supposed Cyclops were Celts, and it is remarkable that the postern gate of Mycenæ is in the form of one of the trilithons of Stonehenge; that the Cyclops worshipped the sun, whose temple, in Britain, is that celebrated remain, as is stated by Diodorus; that its name of *choir gaur*, or *chorea gigantium*, from giants, is synonymous with Cyclops; that an ancient bulwark, near one of the gates of the Grecian Thebes, resembles Old Sarum, or *Sorbiodunum;* that chromlechs have been found in Greece; and that the Roman Druidical use of the Greek alphabet has been confirmed by the Athenian coins found in excavations at Chatham, as stated in Gosling's Walk to Canterbury. Numerous other instances occur of conformity between the ancient British or Celtic, and Cyclopean, or most ancient Grecian architecture; but these are sufficient to identify their origin. In Italy, at Ausidonia, and Saturnia, in the Siamese towns anterior to the founding of Rome, fine specimens of the Cyclopean style are found; and at the old Lycosures in Arcadia, the primary town and metropolis, from whence all the colonies of Italy were derived.—See *Acropolis.*

CYLINDER, (κυλινδρον, Gr.) a solid figure whose base is a circle, and whose curved superficies is every where at an equal distance from the axis, or line supposed to pass through the middle. It is termed a *right cylinder* when the axis is at right angles to the base; but if at oblique angles a *scaline* or *oblique cylinder.* The solidity of a cylinder may be found by multiplying the area of its end by the parallel distance between the two ends. The area of its curved surface may be found by multiplying the girt of the cylinder by the length of the axis. The cylinder was formerly considered as a sacred form, particularly amongst the eastern nations. The deities were often figured as cylinders of wrought or unwrought stone.

CYLINDRIC CEILING, vulgarly termed a *waggon-headed ceiling*, a ceiling vaulted in the shape of a segment of a cylinder. They appear to be not more ancient than the time of the Romans, who used them in small temples, and in the side branches of larger ones. Cylindrical ceilings admit of being pierced by lunettes, which form cylindro-cylindric arches. They should be decorated with coffers, separated by soffits, and enriched with guilloches.

CYLINDRIC DOME. The following rules will serve to find the area of cylindric domes. (1.) To fin the area of a uniform cylindri triangle, multiply the radius by th length of the axis. (2.) To fin the area of a surbassed cylindri triangle, multiply the sum of th square of half the horizontal axis the directing section, and six tim the square of the height of t dome, by the length of the axis the cylindric surface, and divi the product by seven times t height of the dome. (3.) To find the area of a surmounted cylindric triangle, multiply the sum of the square of half the horizontal axis of the directing section, and four times the square of the height of the dome, by the length of the axis of the cylindric surface, and divide the product by five times the height of the dome. (4.) Having found the area of one of the two equal and opposite cylindric triangles of each cylindric surface, add them together, and double the sum; the product will be the area of the dome.

For an example, it is required to find the area of a uniform and surmounted cylindric dome, (CYLINDRIC DOME, *Plate* I.) the length of which is 20 feet, and its breadth 12 feet. In this dome the diameter of the circular directing section will be 20 feet, being equal to the length of the dome, and the horizontal axis of the directing section of the surmounted section will be 12 feet, being equal to the breadth of the dome. But the height of the two cylindric circles being equal, the horizontal axis of the directing section of the surmounted surface will be less than the diameter of the circular directing section. Since the height of the dome is equal to the radius of the circular directing section of the uniform surface, it will be 6 feet. Therefore, by (1) 10 × 12 = 120 triangle CE*a*; by (3)

$$\begin{array}{rr} 6 & 10\\ 6 & 10\\ \hline 36 & 100\\ 400 & 4\\ \hline 436 & 400\\ 20 & \\ \hline 5,0)872,0 & \\ \hline 174{\cdot}4 = \text{triangle } cea. & \end{array}$$

$$\begin{array}{rl} \text{By rule (4)}\ \ 120 & = \text{triangle CE}a.\\ 174{\cdot}4 & = \text{triangle } cea.\\ \hline 294{\cdot}4 & \\ 2 & \\ \hline 588{\cdot}8 & = \text{area of dome.} \end{array}$$

Find the area of a surbassed cylindric full dome, (*Plate* II.) the length of which is 20 feet, the breadth 12, and the height 4. Here both angles fall under rule (2.)

$$\begin{array}{rrr} 10 & 4 & 6\\ 10 & 4 & 6\\ \hline 100 & 16 & 36\\ 96 & 6 & 96\\ \hline 196 & 96 & 132\\ 12 & & 20\\ \hline 7)2352 & & 4)2640\\ \hline 4)336 & & 7)660\\ \hline 84 = \text{CE}a. & & 94{\cdot}28 = cea. \end{array}$$

$$\begin{array}{rl} \text{By rule (4)}\ \ 84 & = \text{CE}a.\\ 94.28 & = cea.\\ \hline 178{\cdot}28 & \\ 2 & \\ \hline 356{\cdot}56 & = \text{area of dome.} \end{array}$$

Cylindroid, a solid which approaches the form of a cylinder differing from it in having the bases elliptical, but parallel and equal Its solidity may be found, like that of the cylinder, by multiplying the area of one of the ends, by the distance between the two. Its superficial content also is found by the same means as that of the cylinder.

Cyma, (κυμα, Gr.) an undulating moulding, which is generally the upper one of a cornice, when it is called *cymatium*. The *cyma recta* is composed of a concave and convex moulding, the former being uppermost. In the *cyma reversa* the convex is uppermost. The term *gula* is sometimes used for *cyma*.

Cymatium, (κυματιον, Gr.) the upper moulding of a cornice, composed generally of a cyma. Of the three kinds of cymatia mentioned by Vitruvius, the *Tuscan* is supposed to have been an ovolo orquarter-round the *Doric* an ovolo or cavetto, and the *Lesbian* the cyma inversa.

Cymbia, a fillet.

Cypress, (*cupressus*, Lat.) The wood of the cypress was much valued by the ancient architects for its hardness and durability. The door-posts of the temple of Menelaus, as described in Homer, were of cypress.

Cyzicenus, (κυζικος, Gr.) a magnificent hall among the Greeks, much resembling the Roman *cœnaculum*. Vitruvius describes the cyzicenus as being situated towards the north, generally having a view of the garden, and having valved windows in the middle, as being of sufficient length and breadth to contain two triclinia, with their appendages, opposite each other; their height being equal to one and one-half of their breadth.

END OF VOL. I.

THE HOME CYCLOPEDIA.

CYCLOPEDIA

OF

ARCHITECTURE,

HISTORICAL, DESCRIPTIVE, TOPOGRAPHICAL, DECORATIVE,
THEORETICAL AND MECHANICAL,

ALPHABETICALLY ARRANGED, FAMILIARLY EXPLAINED, AND ADAPTED TO THE
COMPREHENSION OF WORKMEN, ETC., ETC.

BY

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TWO VOLUMES IN ONE.——VOL. II.

NEW YORK:
A. S. BARNES & CO., 51 JOHN-STREET.
CINCINNATI:—H. W. DERBY.
1854.

DICTIONARY OF ARCHITECTURE

DADO, (Ital. *a die*) the square or cubiform part of the pedestal of a column, or the walls of an apartment. In Egyptian buildings, we sometimes find columns whose capitals are composed entirely of one die or cube of stone. The die is commonly covered with ornamental historical sculptures, in monumental, honorary, or commemorative columns; such as the London monument, and the pillars of Trajan and Antonine. See *Attic.*

DAGOUNG, or **SHOEDAGON**, *temple of*, in the eastern language, the *temple of golden Dagon*; an edifice about two miles and a half north of Rangoon, the most considerable sea-port of the Birman empire: it is not so high as the temple at Pegue, or Shoemadoe, by 25 or 30 feet, but the terrace on which it is built crowns a rocky eminence much higher than any part of the surrounding country, it is approached by a hundred steps, and the spire and some other parts of it are richly gilt, which when, illuminated by the rays of the sun, is seen at a great distance, forming a most conspicuous and splendid object. The borders of the terrace are planted with rows of shady trees, and the widely extended prospect of the surrounding country is highly interesting.

DAIRY, (from *dey* milk, old English) apartments fitted up for the preservation and management of milk, and the manufacture of butter and cheese. The dairy should always be kept in the neatest order, and so situated that the windows, or lattices, neither front the south, south-east, nor south-west: lattices are also to be preferred to windows, admitting a free current of air; an oiled paper blind on a wooden frame may be fitted to the lattice, and used occasionally as a protection against extremes of rainy or windy weather, or the heat of the sun. A dairy house cannot be kept too cool in summer; and on this account a good spring or current of water ought to be near it. It should be neatly paved, with smooth hard stone, or good brick; laid with a proper descent, so that no water may lodge. This pavement should be washed every day in summer, and all the utensils kept quite clean. The size of the dairy will depend on the number of cows; a dairy-house in Gloucester, for forty cows, is usually 20 by 16 feet, and 30 by 40 feet for 100 cows. A well-constructed cheese-dairy should contain four rooms: one for the reception of the milk; another for the press room; a third to salt and finish the cheese, and a fourth on the highest part of the building, for a warehouse.

The butter dairy will require three apartments: the milk-room; the churning-room, with the necessary apparatus; and a room for the various utensils.

Dam, (*Demman*, Sax). A mole or fence to confine water, for a reservoir for mills, and other purposes; it should be built with stones in the strongest style of masonry. The usual mode of construction on large streams is a straight line passing obliquely across, from bank to bank, in some degree dividing the force of the current between the two sides of a triangle, one side of which is the bank of the river or brook; but the more improved method is to build the dam in two lengths, which meet and form an angle, whose vertex is pointed up the stream; and a yet more improved construction is the segment of a circle, in form of an arched bridge, with its head opposed to the stream, and its abutments against the banks.

Damascus, see *Arabian Architecture.*

Dampness, is said to prevail most in buildings finished hastily; because the materials which compose the walls having never been dry, conform themselves to the humidity of the soil, which humidity rising, in a regular current, by capillary attraction, never allows the possibility of the walls afterwards becoming dry. A complete layer of powdered charcoal mixed with pitch, or rosin, and powdered pit-coal, laid over one of the courses of the wall near the foundation, will remedy this evil.

Dankali, see *Abyssinian Buildings.*

Danube. If no other circumstance had given importance to this magnificent river, the great bridge, thrown across it by Trajan, would have made it sufficiently remarkable. "Trajan," says Dion Cassius, "built a bridge over the Danube, which in truth we cannot sufficiently admire; for though all the works of Trajan are exceedingly great, yet this is the greatest. The piers were 20 in number, each 150 feet high, 60 feet in breadth, and distant from each other 170 feet. The expense of this work must have been very great, and the undertaking was more difficult on account of the river being very rapid, and its bottom of moveable materials; it was in the narrowest part of the river, and on that account deeper and more impetuous. The arches were afterwards beaten down by Adrian; but the piers yet remain, as if to testify that there is nothing which human ingenuity is not able to effect. The whole length of this bridge was 1590 yards."

Days, or **Bays**, in Gothic architecture, the compartments formed in tall windows by the intersection of a mullion, which of one larger window makes two narrow ones, to each of which the name of day has been given, and, by the successive introduction of additional mullions, very large windows have been formed into six, seven, and even nine days. See *Angle*, *Bar*, and *Gothic Architecture*.

Deafening sound boarding, a method of preventing the passage of sound through wooden partitions. See *Pugging*.

Deals, the wood of the fir tree, to which this name is given when cut into planks, or thin boards, and pieces of various descriptions for building and other purposes: white and yellow are the two sorts generally used, which are brought to England from Norway, Prussia, and Russia. Deals of various lengths, and three inches thick, are kept on hand by the London timber merchants, the breadth of which varies, but seldom exceeds nine inches. These are cut into *boards* or *leaves;* those divided into two are called whole deal, into four slit deal, and into five, five-cut stuff. Deals are made harder by being thrown into salt water as soon as they are sawn, and drying them in the air after they have remained in the water several days; but if not well seasoned they will be liable to shrink after remaining some time exposed to the action of a changing atmosphere. In floors, partitions, doors, windows, architraves, mouldings, cornices, columns, pilasters, chimney pieces, and in plain and ornamental work of every description, this kind of wood is universally preferred. For inside work, in bed-rooms, and for panels, the white deal is more particularly adapted; and the yellow, being harder, and retaining a large portion of resinous substance, is better fitted to resist the effect of the weather in out-door work.

Decagon, (Gr. *δεκαγωνος)*, a plain figure, having ten sides and angles.

Decastyle, (Gr. *δεκαστυλος*), a portico, temple, or other building, with ten columns in front, as in the temple of Jupiter Olympus.

Decempeda, (*decem*, ten, and *pes*, foot, Lat.), a rod of ten feet, used by the ancients in measuring. It was subdivided into twelve inches in each foot, and ten digits in each inch; and is mentioned by architects in reference to the proportions and dimensions of their buildings.

Decimal (from the Lat. *decimus*) increasing by tens.

Decimal Scale. Scales of this kind are used by draftsmen, to regulate the dimensions of their drawings; they are generally of the denomination of ¼ inch, in which every ¼ of an inch is divided into ten parts, or of half inch, &c. so divided. A pair of proportional compasses may be used for the same purpose, and will always be found more accurate and expeditious.

Declination, of the Doric mutules. See *Mutule*.

Decoration. Any thing that enriches or gives beauty to a church, triumphal arch, or other building. The orders of architecture contribute greatly to decoration, for which purpose their just proportions and characters must be strictly preserved. Paintings, vases, festoons, and images, are used in churches; particularly in Italy, on solemn festivals. Theatrical decorations are changeable, and suited to the varying scenes; and the splendid embellishments of princely palaces call forth the exertions, and preserve the works, of the first artists of the age to which they belong. In the decoration of the walls of the apartments of common dwelling-houses, paper hangings of various descriptions have been chiefly used; or plain colours have been applied to the walls; or they have been figured with various devices. A patent taken out in 1806 by R. Clarke and T. Fricker for a method of decorating rooms with flocks of woollen cloth, or of silk or of cotton cut short; which is fastened to the wall by means of the following composition, called by the inventors, a *mastic;* one gallon of linseed oil, one gallon of spirit of turpentine, and one lb. of gum anime, boiled to the consistence of tar. The wall is brushed over with this composition, and the flocks, finely cut, made to adhere by blowing through a tube with a pair of bellows; the flocks dyed of an uniform colour, and a similar colour previously put on the wall; and if the composition be laid on the wall in the form of flowers or foliage, or other figures, the flocks will be made to adhere upon these alone.

Decuman Gate. See *Castra.*

Deliquiæ, (Lat.) a term used by Vitruvius, to designate the rafters which formed the ridge of the roof, and threw the water on each side.

Delos, (Gr.) an island in the Ægean sea, celebrated for the number and excellence of its artists, and its famous temple dedicated to Apollo, and its magnificent statue of Jupiter Tonans, of fine Delian bronze. See *Altar.*

Delphos, an ancient city of Phocis, in Greece, celebrated for its temple, in which was the Cortina, or mystic tripod. See *Arch.*

Delubrium, (Lat.) the most sacred part of ancient temples.

Demi-Metope, the half of a metope, which is found at the retiring or projecting angles of a Doric frieze.

Dendera, a village of Egypt; about a mile and a half to the west of which, and half an hour's ride from the river Nile, are the magnificent ruins of the ancient *Tentyra,* from which it takes its name. The ruins occupy more than a mile in length, and in breadth about half a mile.

"The first thing," says Dr. Richardson, "that attracts the eye of the traveller, is a small square stone building with four columns, constructed of the same species of sand-stone as the temple, and probably connected with it for religious purposes. Advancing several hundred yards over brick ruins, we come to an elegant gateway, or propylon, also of sand-stone, completely covered with hieroglyphics. Immediately over the centre of the door-way is the beautiful Egyptian ornament of the globe, with the serpent and wings. To this succeed representations of Osiris, Isis, and Orus, with processions of priests and people advancing to pay their homage, and present their offerings on their knees. Advancing about a hundred paces, we arrive at the celebrated and beautiful temple of Dendera; its front is covered with a vast profusion of ornaments, the door lofty, with perpendicular sides, on each of which are three massive columns, capitalled with heads of Isis, quadrifrons. The Vulture, queen of the air, (sacred to Isis or Juno, the guardian genius of the kings and heroes of Egypt,) with outspread wings and a broad feathered sceptre, held by a ring in each foot, begins and ends the magnificent assemblage of sculptures, which extend over the walls of the Pronaos. On each hand are three rows of columns, three in each row; in all eighteen; of the form of those of the portico, and with similar capitals, and covered with hierogliphics. Similar columns are ranged on either side as we enter the temple, which is choked up with sand and stones: two succeeding apartments are without pillars, but the walls of all are profusely decorated; and from the last, several passages branch off, leading to hand some side-chambers, ornamented with figures, and stars, and hieroglyphics, and a sort of chain-work along the ceiling, which is blue.—Proceeding in a direct line, we enter a spacious chamber, in the centre of which is the sanctuary; both of these apartments are richly ornamented. Returning towards the rooms we had left behind us, we ascend an easy flight of stairs leading to the top of the building; singular ornaments, and a more varied succession of figures, crowd every compartment, and continue to the top, which is an extensive area, covered with the remains of numerous cottages in a state of ruin; beyond which is the entrance to the upper chamber of the temple. The figures here are of enlarged dimensions—some in gorgeous apparel, others naked. This temple is by far the finest in Egypt; the devices are most intellectual, and the execution superior. A highly ornamented chapel is seen near the northern extremity; and a second, of a similar description, is that called by Strabo, the Typhonium. The distorted head of the ugly Typhon forms the capitals of the pillars, and his graceless form appears on its walls.

Belzoni inferred, from the superiority of the workmanship, that this temple was of the time of the first Ptolemy: the style of the architecture bears little resemblance to any Roman works; but it appears to have undergone repairs and decorations at successive periods down to the time of the Antonines. The hieroglyphics on the walls of the temple itself, are found to contain the names of Tiberius and Augustus; and the Greek inscription over the entrance to the Pronaos, states it to have been erected by the inhabitants of the Nome, when Publius Avillius Flaccus was prefect of Egypt, about A. D. 34. Another inscription on one of the propylons of the temple of Isis, bears date the 31st year of the reign of Augustus, A. D. 23; and Mr. Salt observed in different parts of these temples the names of Trajan, Adrian, and the Antonines.

Dendrometer, (Gr.) an instrument adapted to the purpose of measuring trees.

Dentels, or **Dentils**, are ornaments in a cornice in the form of indentations or teeth; this member is called a *denticule*, or a *denticulated band;* which, according to Vitruvius, is to equal the height of the middle fascia of the architrave, and its projection to be the same as its height; of which the dentils are one half, and the intervals between them two-thirds of the height. This ornament is chiefly found in the Ionic and Corinthian orders, but it is not made conformable to any regular proportions. They are exhibited in the Ionic temples of Bacchus at Teos, and Minerva Polias at Priene; the temples of Fortune and Concord, and the theatre of Marcellus at Rome, and the aqueduct of Adrian at Athens.

Instances of this ornament in the Corinthian order are found in the monument of Lysicrates, the arch of Adrian, and the ruins of Salonica; the temples of Peace, and of Jupiter Stator; and the baths of Dioclesian, and the piazza of Nerva, at Rome; the temple of Jupiter at Spalatro, and in the ruins of Balbec and Palmyra. The frontispiece to the Tower of the Winds; and the portico of the temples of Pandrossus at Athens; the Arch of the Goldsmiths, of Septimius Severus, and that of Titus at Rome, are instances of the Composite order with the denticulated band.

This ornament is frequently omitted in all the orders. See *Cartouch*.

Depôt, a military store-house, with conveniences for the reception and training of recruits: an edifice for this purpose should be strongly fortified, and contain numerous apartments, the lowest tier of which should be below the ground-floor, for provisions requiring to be kept from sun and air; artillery and ordnance stores are on the ground-floor, the walls of which support battens of wood, against which pikes, halberts, swords, muskets, carbines, pistols, and small arms of every description, are piled; camp equipages, ready prepared cartridges, and similar matters, occupy the second floor; and the powder magazine is in a strongly fortified separate building, bomb proof.

Desaguadero. A most ancient bridge, built by Capac Yupanqui. See *Bridge*.

Description of building-work. See *Building*.

Descriptive Carpentry. By this term is understood that branch of the art which teaches to lay down on a plane, sections, parts, &c. of the different works required to be executed. We shall introduce here the following problems; others will be found under different articles.

To draw a cylindrical soffit, cutting right lines in a wall, which does not stand perpendicular to the ground, to a level base, *pl.* I. *fig.* A, let *a e* at D be the level of the ground, *a l* the inclination of the wall, (= radius of cylinder) let fall the perpendicular from *l* to *c*, in the line *a e* make the semicircle in *fig.* A; to the width of the cylinder, or the double of *a l* at D, take the distance *a c* at D, and make *a b* equal to it in *fig.* A, and describe a semi-ellipsis to the length *d d* of the diameter of the semicircle, and to the width *a b*, lay the equal divisions round the semicircle in *fig.* A, along the line *d d* double at C, take the parts *e d*, *d c*, *o b*, *b a*, from plan B, and lay them at D respectively from *e* towards *d c b*, from *l* draw *l e* at right angles with *l a*, from the points *a*, *b*, *c*, *d*, draw perpendiculars to cut *l e* at *f*, *g*, *h*, *i*, take the distances *e i*, *i h*, *h g*, *g f*, lay them on the soffit at C each way from 1 *d*, 2 *c*, 3 *b*, 4 *a*, and the straight line *d d*, when bent round, will be perpendicular over the elliptic line in the plan B, and the curve line *d d c b a*, &c. *d* will will fall over the points *d*, *c*, *b*, *a*, in the plan.

To draw the sections of simple prismatic arches, that may form groins in vertical planes. Let *fig.* E, be a Gothic arch, draw the chord *a c* for one half, divide it into any number of equal parts as four; through the divisions draw lines from the centre *e* to the circumference at *h g l*, draw lines from *c* through *h*, *g*, *l*, to cut the perpendicular *a d* at *b*, *c*, *d*: if number 2 is required to be wider, and of the same height, draw the two chords *a c* and *c b* for each side, divide each as before, and set the divisions *a*, *b*, *c*, *d*, perpendicular on each end of *a b*; from these divisions draw lines to the crown at *c*, trace the curve through *h*, *g*, *l*, &c. so that the arch at number 2 will truly mitre into *fig.* E; in the same manner the rampant curve at number 3 will be brought to correspond with *fig.* E and number 2.

To describe the ribs for the head of a niche, the curve in which the spherical surface intersects the face of the wall being a semicircle, and the plan a segment. Let ABC (*pl.* II.) be the plan, AB or BC the half of arc ABC will be any one of the ribs, which are to be fixed to the front rib at the points *a*, *b*, *c*, *d*, *e*, at equal distances in the circumference, to be mitred together in the pole F of the spherical surface.

To find the ribs of a spherical niche, of which the plan is the segment of a circle, and the elevation a semicircle, supposing the ribs to be small circles mitred together, so that their mitres may terminate in the summit of the back of the front rib. Let AE, BE, CE, DE (*pl.* III.) be the seats of one half of the ribs, produce BE to intersect the circumference at F, make FM = BE, and on BF, as a diameter, describe an arc FI, draw MI perpendicular to MP, intersecting the arc at I, FI will be the under edge of a rib in a perpendicular plane upon EB. The other ribs may be described in the same manner. The bevelings of the ribs may be found by making the distance of the wood to be cut away on the bottom of each rib, according to their seat, as shown at FG, which are the same as those on B and C. The rib on DE is a great circle, and wants no bevelling. See *Carpentry*.

Design, (*Designo*, Lat.) a drawing or plan of an intended building, projected by the architect, according to the rules of art, with taste and judgment; including plans, sections, and elevations. For a small erection, a ground-plan and elevation will be requisite; but for a large building, elevations of each of the fronts and plans of every story, and transverse and longitudinal sections, with drawings of all the bases, capitals, friezes, cornices, architraves, mouldings of various descriptions, and all the smaller parts of the work, in geometrical proportion. A perspective view will also be necessary, taken from a position where the erection will be seen in all its parts. A model is sometimes required, and found of great utility in large buildings. See *Apartment*, *Building*, *House*, *Effect*, *&c.*

Details of an edifice, drawings or delineations for the use of the builders, otherwise called working drawings.

Determining Line, in conic sections, a line parallel to the plane of the base of the cone. In the hyperbola this line is within the base of the cone: it forms a tangent to the base in parabolic sections, it falls without in the elliptic. In the intersecting of a circle, the determining line will never meet the plane of the base to which it is parallel.

Diaglyphice, a species of sculpture in which the strokes or lines are indented, opposed to the usual mode, in which the figures are prominent. See *Anaglypha*.

Diagonal, (διαγωνιος, Gr.) a straight line from one angle of an angular figure to another. Rectangular figures of every description, may be divided into as many triangles, except two, as they have sides. The diagonal divides the parallelogram into equal parts.

Diagonal Scale, is a scale subdivided into smaller parts by secondary intersections.

Diameter, the line in a circle passing from the circumference through the centre.

Diameter of a Column, a line passing through its base, or thickest part, which gives the measure proportioning the intercolumniation, in some of the orders.

Diameter of Diminution; the diameter at the top of the shaft of a column.

Diameters Conjugate, two diameters of a circle made to form right angles.

Diamond, a sharp instrument formed of that precious stone, and used for cutting glass.

Diana, Temple of. See *Arch*, and *Ephesus*.

Diastyle, a term applied to a building, with columns at the distance of three diameters from each other; also applied to the columns themselves when so arranged. See *Colonnade*. The breadth of the façade of the diastyle portico of a temple was divided into 28 parts where it had four columns, and into 44 when it had six. The half diameter of these columns was equal to one of those parts.

Diathyra, (Gr.). The vestibule before the door of a Grecian house, answering to the Prothyra of the Romans.

Diatoni, or **Diatonic Stones**, Cubical stones with two wrought faces, used by the ancient builders as angle or corner stones. They were as broad as the thickness of the wall, and proportionally longer than wide.

Dianton. The race-course, the circuit of which being two stadia, or twelve hundred feet, was used also to signify that measure.

Diazomata, (Gr.) the passages, or corridors which separated the ranges of seats in the theatres; by the Romans called *battai*, or belts, and also *præcinctiones*.

Dicapolis: see *Ægesta*.

Dictyotheton, (Gr.) by the Romans called *reticulata structura*. A building, with walls to admit light and air, in the form of lattice or net-work.

Didoron, a brick, one foot long and six inches broad, used by the Grecian builders; also a Greek measure of two spans.

Die, or **Dye**, (*dé*, Fr.) See *Dado*.

Digging. A man with a spade, in a soft ground, will throw up a cubic yard of 27 feet in an hour: where a mattock must be used, that quantity will require two men; and a very strong gravel, three. If the work be of the first description, and the labourers' wages 2*s*. 6*d*. per day, a yard will cost 3*d*. digging; if a hacker be required, 6*d*.; and if two be necessary, the amount will be 9*d*. per yard. It will require three men to wheel 30 cubic yards of gravel in a day, to the distance of 20 yards.

Diglyph, (from διγλυφος, Gr.) a double channelled tablet.

Dimension, (*dimetior*, Lat.) in geometry, is either length, breadth, or thickness: as a line has one dimension, of length; a superficies has two, length and breadth; and a solid has the three dimensions of length, breadth, and thickness.

Diminished bar of a sash, is thinner on the inner edge toward the room, than on that toward the glass of the window.

Diminishing of a column, is the difference in the top and bottom diameters, found in all the regular orders. This diminution proceeds gradually from the bottom in Greek and Roman specimens, yet some modern writers direct the shaft to diminish from the third part of the height. Gothic pillars are of equal thickness from top to bottom. The first columns were the trunks of trees; which the artificial column imitates, gradually tapering from its base upwards. This diminution is regulated by a scale of proportions. The bottom diameter of a column 15 feet high, is to be divided into equal parts, and each of these to be divided into 10, being a division of the whole into 60 minutes. The diminution ought to be one-sixth, and the top diameter 50 minutes. The lower diameter of a column from 15 to 20 feet in height, is to be divided into 6½ parts, and the top diameter will be 52 of these. The lower diameter of a column rising to the height of from 20 to 30 feet, must be divided into 7 parts; and the upper diameter will be 6 parts. If the column be from 30 to 40 feet high, divide its lower diameter into 7½, and let the top be 6½ parts in diameter. If the column be from 40 to 50 feet high, divide the lower diameter into 8 parts, and diminish the upper diameter to 7 of those parts. Similar proportions are given to columns of greater altitude, the proportional diminution of the upper diameter being less as the height increases. See *Entasis*.

Diminished Arches. Arches less, or lower, than a semicircle, denominated, by the French architects, *voute surbasse*.

Dining, or Dinner Room, is generally one of the largest rooms in a dwelling house; in stately mansions extending to 40 feet in length, and even 50, and the breadth from half to three-fourths of the length. The dining rooms in middle-sized houses are from 18 to 24 feet in length, 16 to 18 feet wide, and 13 feet high; in smaller houses the largest room ought to be appropriated to this purpose. See *Andron*.

Dinocrates, an architect, who was patronized by Alexander the Great: Vitruvius relates his history. "At the time that Alexander was conquering the world, Diocrates left Macedon, and repaired to the army. He carried along with him letters of recommendation from his friends, and from several nobles of the first rank. On his arrival he was favourably received, and begged to be immediately presented to the king. But finding himself trifled with, and from time to time disappointed, he determined to depend upon himself, his own knowledge and genius, and the endowments of nature. He was large of stature, with an agreeable countenance, and a dignity in his form and deportment. Determined in his purpose, he clothed himself in the habit of Hercules, anointed his body with oil, and, crowning his head with boughs of poplar, approached the tribunal where the king was administering justice. The novelty of his appearance attracted the attention of the king, who commanded him to approach, and declare who he was. I am, replied Dinocrates, a Macedonian architect, who come to thee with ideas and designs worthy of the greatness of thy fame; I have formed a design to cut Mount Athos into the statue of a man, in whose left hand shall be a large city, and in his right a bason, which shall receive all the rivers of the mountain, and again discharge them into the sea." Alexander, delighted with the idea, immediately inquired, if the country adjacent would produce sufficient food for the sustenance of the inhabitants. When informed that provisions must be conveyed thither by sea, he replied: "Dinocrates, I discern the excellence of thy design, and am pleased with it; but I consider, that whoever should establish a colony in such a place, would hereafter be justly blamed; for, as a new-born infant cannot be nourished, or gradually reared to the different stages of life, without the milk of the nurse; so neither can a city be peopled, nor can it thrive, without fertile land, and plenty of provisions: however, as I approve the design, though I disapprove the place, I will have thee attend me, that elsewhere I may find thee employment." Alexander, afterwards observing a spot in Egypt where nature had formed a secure haven, an excellent place for an emporium, the adjacent country through all Egypt being fruitful, and having the accommodation of the river Nile, ordered him to build the city now called Alexandria, receiving the name of the emperor, and perpetuating the fame of the architect. Dinocrates also superintended the rebuilding of the celebrated temple of Diana of Ephesus. On the death of Arsinoe, the queen of Ptolemy Philadelphus, Dinocrates, by order of the king, formed the design of a temple to be erected to her memory, in which, under a magnificent dome, a statue of the queen should be suspended by a magnet: but the king and the architect died before the accomplishment of this undertaking.

Dipteron, (διπτερος, Gr.) a temple with a double row of columns. According to Vitruvius, dipteral temples were octostile; they could not indeed be less, to leave room for the cell, but they might also be decastyle. The dipteral is one of seven orders of sacred architecture of the ancients, and the Doric temple of Jupiter Quirinus was of this order, having eight columns, both in front and rear, with a double row of columns round the cell. The Ionic tempel of Diana, built by Ctesiphon at Ephesus, was also dipteral and octostyle.

Discharge, (*décharge*, F.) the relief given to a beam, or piece of timber, overcharged by too great an incumbent weight of building: when built under, it is said to be discharged.

Discharging arches, are those built over wooden lintels, by which the bearing upon them is taken off. The chords of discharging arches are not much longer than the lintel, being the segments of very large circles. A temporary lintel is frequently inserted, which is afterwards removed when the building is finished, and sometimes the arches are built without lintels.

Discharging struts, synonymous with the terms auxiliary rafters, or *principal braces*.

Dishing out, or *cradling;* wooden vaultings, or coved rib-work for plastering upon.

Displuviatum, a kind of court or cavædium, mentioned by Vitruvius, which was entirely uncovered, and exposed to the rain.

Disposition. This term applied to a building is understood to mean the proper situation and arrangement of the apartments, entrances, and various parts belonging to it; and is, according to Vitruvius, one of the essentials of architecture. It is divided into three parts—Ichnography, Orthography, and Scenography; in other words, plan, elevation, and perspective view. *Disposition* embraces every particular relating to the purpose of an architectural design.

Distegia, a machine used in the theatres of the ancients, which represented an edifice of two stories, from the top of which might be seen what was passing below.

Distemper, (*Detremper*, Fr. to modify or assimilate,) applied to painting, with colours mixed up with size, or some kind of unctuous or glutinous substance. All the cartoons and pictures of the ancient artists, previous to the year 1410, are said to have been done in *distemper*.

The size being first mixed with water, each of the colours to be used is ground up, and put in separate pots, to be diluted with size when wanted for use; the pots to be kept covered with pieces of bladder. This ancient mode of painting is applicable to wood, plaster, canvass, parchment, or paper. In Egyptian temples and tombs, and among ancient Grecian and Roman antiquities, paintings of this kind are found in a perfect state of preservation. Distemper, when on walls, must be executed when their surface is dry; in this respect, differing from *fresco*, which being painted on the moist plaster, enters into its composition. See *Fresco*.

Distribitorium, the name of an edifice at Rome, begun but left unfinished by Marcus Agrippa, and situated in the region of the circus of Flaminius. We are ignorant of its precise destination, but we know from Dion Cassius, that during the great heat of summer, it was used as a theatre; it was of vast extent.

Ditriglyph, the intervening space between two triglyphs: in intercolumniations, the placing of two triglyphs over the intercolumn, so that a triglyph being placed over each of two outermost columns, will form the ditriglyph, containing three metopes or spaces, two whole triglyphs, and two half triglyphs.

Dividicula, (Lat.) called also *castellein*, in ancient architecture, the basin which received the water from an aqueduct, and from which it ran to the different parts of the city.

Dodecagon, (*δωδεκαγονία*, Gr.) a regular polygon, with twelve equal sides and angles; in fortification, a place with twelve bastions.

Dogleggēd stairs. See *Constructive Carpentry* and *Stairs*.

Dome, an arched or vaulted roof, springing from a polygonal, circular, or elliptic plan. When the base is a circular, it is termed a *cupola;* when a polygon, it is a *polygonal dome;* and when an ellipsis, an *elliptic dome*. The central point in the curved surface is called the *pole* or *centre*. The imaginary straight line, descending from the pole to the base, is the *axis*. When the altitude of a dome is greater than the radius of the base, it is said to be *surmounted;* when less, *surbased*. The *sectorial radius* of a segment of a cylindric polyhedron is the straight line from the pole to the middle of one of the sides of the base; or if the dome be the frustum of a cylindric polyhedron, it will have also two sectorial radii extending from the pole to the middle of a side of each polygon. The curved surface of every dome, which is a segment of a cylindric polyhedron, is equal to a regular polygon, whose apothem is equal to the sectorial radius; or to a rectangle, whose length is equal to the perimeter of the equatorial polygon, and the breadth equal to the height of the dome. When the base of a circular directing section of a cylindric dome is greater than the base of the elliptic directing section, the dome is said to be *uniform and surmounted;* when less, it is *uniform and surbased*. When both directing sections are elliptic, and the base of the one upon the axis major, and that of the other upon the axis minor, it is *surmounted and surbased*. In the plate Dome, I. *fig*. 2. is a dome, in the form of a semicylindric polyhedron, seen externally; 3. a dome, in the form of a segment of the same solid, seen externally; 4. a dome in the form of a zone, of a semicylindric polyhedron, from the outside; 5. a dome in the form of a hemicylindric polyhedron seen internally; and 6, a dome in the form of a zone of a hemicylindric polyhedron seen internally, the polygonal aperture above is called the *eye of the dome*.

To estimate the curved surface of a dome, which is the segment or zone of a sphere, when a section along the axis of the zone is given, we must, for the *segment*, find the sectional radius, and apply it to the scale, then find the area of a circle, whose radius is equal to the number of feet in the sectorial radius, as indicated by the scale, and the area of this circle is equal to the curved surface of the spheric segment: for the *zone*, we must complete the entire segment, find the sectorial radius of the part cut off, and that of the entire segment, and the measure of each sectorial radius by the scale, the difference of the areas of the two circles will be equal to the curved surface of the zone. For example, How many feet are contained in the concave surface of a spherical dome, whose segment ABC, (*fig.* 1. Dome *Plate* III.) is a section through the axis, and EF at the bottom of the plate a scale of feet. Bisect AC by a perpendicular BD, and join AB: AB is the sectorial radius, and from the scale will be found to be about 27 feet. Since the area of the surface of a dome is equal to a circle, whose radius equals the sectorial radius, the area of the circle is found by multiplying the square of the radius by 3.1416, or the square of the diameter by 7854.

sq.rad. 729	or, sq. diam. 2916
3.1416	7854
282744	11664
62832	14580
219912	23328
	20412
2290.2264 feet.	
	2290.2264 feet.

In like manner may be found the content in feet of a dome, which is the segment of a sphere, of which ABC, *fig.* 2, is a section along its axis, the sectorial radius being found to be 41 feet. Ans. 5281.0296 feet. How many cubic feet will be required to build a stone dome in the form of a sphere, the section along BD, *fig.* 3, the axis of the convex side being ABC, and the thickness of the dome 8 inches? Here the sectorial radius AB will be found to measure 38 feet 6 inches: the diameter of the circle will be 77 feet, (38f. 6 in. × 2).

sq. of diam. 5929
multiplied by 7854
= 4656.6366 arc of diam. in sq. ft
8 inch.
12)37253.0928
3104.4244 solid contents.

How many yards are contained in the concave surface of a dome, which is the zone or frustum of a sphere, given the section ABCDE, (*fig.* 4,) along the axis, AB and DE being the two equal circular arcs? Complete the entire segment ABCDE, let C be the pole of the spheric segment, draw the sectorial radii CA and CB, which will be found by the scale to be respectively 45ft. 6in. and 17ft. 6 in.—91ft. (45½ × 2) is therefore the diameter of a circle equal to the area of the entire segment of the sphere, and 35 feet (17½ × 2) the diameter of the segment of the sphere cut off. The shortest operation is thus: square the sectorial radius of the segment cut off, and that of the entire segment, subtract one from the other, multiply the remainder by 7854, and the product will be the area of the frustum. Thus:—

sq. of 91 = 8281
sq. of 35 = 1225
7056
multiply by 7854
9)5541.7824 area in ft.
615.7536 area in yards.

To find the area of a dome which is any segment of a regular semicylindric polyhedron, we must find the area of a regular polygon, which has the same number of sides as the dome, and which has the perpendicular from the centre to one of the sides equal to the sectorial radius. Having described the polygon to the sectorial radius, the length of one of its sides may be found by the scale in the plate: find the area of one of the triangles, multiply it by the number of the sides of the polygon, the answer will be the area of the polygon and of the dome. The area of the polygon will be found more accurately and more expeditiously by means of the following table of the areas of regular polygons, the radius of the inscribed circle being unity.

Name.	*Area.*
Tetragon	4
Pentagon	3.6327
Hexagon	3.4641
Heptagon	3.3710
Octagon	3.3137

To find the area of a curved surface of a dome, which is the segment of a semicylindric tetrahedron, HIK, (plate Dome II.) being the section along the axis perpendicular to the sides. The plan of this dome is a square, (ABCD) of which each side is equal to the chord HK of the given section. The sectorial radius HI being drawn, will be found to measure by the scale 24.5 feet, therefore 26 feet is the radius of the inscribed circle of a tetragon or square, equal in area to the curved surface of the segment of the dome (or 24.5 × 2) 49 feet is the side itself: hence 49 × 49 = 2401 ft. From the centre *i* with the radius HI describe the circle *abcd*, and about it describe the square *efgh*, the area of this square is 2401 feet.

To find the area of the curved surface of a dome, which is the segment of a cylindric polyhedron, the number of sides and the sectorial radius being given, multiply the square of the sectorial radius by the area of a regular polygon of the same number of sides as the dome, having unity for the radius of its inscribed circle, (see preceding table), and the product will be the area of the dome. To find the area of the curved surface of a truncated spherical dome, when the chord of an arc of a great circle and the versed sine of that arc are given: (1) Divide the square of the given chord by the versed sine, and it will give the diameter of the great circle; (2) multiply this diameter by 3.1416 and it will give the circumference; (3) multiply the circumference by the height of the dome, the product will be the curved surface. To find the area of the curved surface of a truncated spherical dome, when the diameter of each of its circles, and the height of the dome, are given: from the square of the semidiameter at the base, subtract the sum of the squares of the semidiameter at the top and of the height, divide the remainder by twice the height, the quotient is the distance of the plane of the base, extract the square root of the sum of the square of the semidiameter at the base, and the distance of the plane, the root doubled is the diameter of the great circle, multiply this by 3.1416 and it will give the circumference, which multiply by the height of the dome, and the pruduct will be the answer.

For more information on the mensuration of domes, see the excellent work on practical mensuration by Peter Nicholson. The following table is given by Dr. Robinson, of the dimensions of what he considers the best form of a dome. The thickness is supposed uniform. The numbers in the first column of the table express the portion of the axis counted from the vertex, and those of the second the length of the ordinate.

AD	DB	AD	DB
0.4	100	1522	1360
3.4	200	1738	1400
11.4	300	1984	1440
26.6	400	2270	1480
52.4	500	2602	1520
91.4	600	2990	1560
146.8	700	3442	1600
223.4	800	3972	1640
326.6	900	4432	1670
465.4	1000	4952	1700
610.4	1080	5336	1720
744	1140	5756	1740
904	1200	6214	1760
1100	1260	6714	1780
1336	1320	7260	1800

"The curve formed according to these dimensions will not appear very graceful, because there is an abrupt change in its curvature at a small distance from the vertex. If, however, the middle be occupied by a lantern of equal or of smaller weight than the part whose place it supplies, the whole will be elegant, and free from defect."

The strongest form of a circular vault, required to bear a weight on its top, is considered to be that of a truncated cone, similar to the exterior dome of St. Paul's, in London. The equilibrium and pressure of domes differs considerably from that of common arching. In order to equilibrate the figure of a dome, the curvature may be changed into a concavity, after the convexity has been carried to its full extent of equilibrium, round, and equidistant from the summit on the exterior side. For, since the interior circumference of the curves is less than the exterior, the course cannot fall inwardly, without squeezing the stones into a less compass. In dome vaulting, a certain weight laid on the top must burst it outwardly, and this weight becomes greater, the more the contour approaches the chords of the arches of the two sides. A certain degree of curvature therefore must be given, which will just prevent the stones in any succeeding course from being forced out. Circular vaults may be open at top, and the weakest will bear a lantern of equal weight with the part which would have completed the whole.

The oldest dome we know of, is that of the Pantheon, at Rome, built under Augustus. The dome of St. Sophia, at Constantinople, was built in the reign of Justinian, by Anthemius and Isidorus, and is nearly 113 French feet in diameter. The other most celebrated domes are those of St. Peter's at Rome, by Michael Angelo, of St. Paul's at London by Sir Christopher Wren, of the cathedral of Santa Maria at Pisa, by Arnolfo Lusii and Brunelleschi, of St. Mark at Venice, and of the Pantheon at Paris by J. G. Soufflat. The wooden dome of the Halle du Bled, at Paris, is 200 feet in diameter, and a foot in thickness. See more on construction of domes under the article *Constructive Carpentry*.

In CONSTRUCTIVE CARPENTRY, *Pl.* IX. is given a section of the dome of St. Paul's. AA *a a* AA is a dome of bricks, two bricks thick, which, as it rises every five feet, has a course of excellent brick of 18 inches long, bending through the whole thickness. The centering of this dome was contrived to serve also for scaffolding: every story was circular, and, the ends of the ledgers meeting as so many rings, it supports itself. The dome is strongly hooped with iron, and was painted by Sir James Thornhill. BB *b b* BB a cone of bricks, 1ft. 6in. thick, also plastered and painted. By this cone the timber work is well supported, the horizontal or hammer beam, CC,DD,EE,FF, being curiously tied into the corbels G,H,I,K, with iron cramps, which are well bedded into the corbels with lead, and bolted to the hammer beam. The stairs which lead to the Golden Gallery, at the top of the dome, run between the trusses of the roof. The dome is boarded from the base upwards, and the scantling of the curve rib of the truss is 10 in. by 11 at bottom, and 6 by 6 at top. On the top of the dome is a cupola of Portland stone, 21 feet in diameter, and 64 feet high. The diameter of the dome is 104 feet and in the circumference are 32 trusses.

Domestic Architecture, is properly that branch of the art which relates to private dwellings, including cottages, farm-houses, &c. for account of which, see *Rural Architecture*.

Domicil, (*Domicula*, Lat.) a little house.

Domus Aurea. See *Banqueting Room*.

Donjon, or **Dongeon**, (Nor. Fr.) The massive tower in the interior of ancient castles, to which the garrison might retreat in case of necessity. See *Keep*.

Dooks, flat pieces of wood of the shape of bricks, about nine inches long, inserted in the wall; so called in Scotland, but in London called plugs, or *wooden bricks*.

Dorchester, Roman Amphitheatre at. See *Amphitheatre*.

Doric Capital. See Capital.

Door, (*dor*, Sax.) the gate or entrance of a house, or other building, or of an apartment in a house. Doors are to be proportioned, and adapted to the use for which they are intended. In correspondence to the human size, the door of a dwelling house is 7 to 8 feet in height, and 3 to 4 feet in breadth. The entrance doors of churches and public buildings should be wide, to allow a multitude to pass without difficulty; and their height should be in proportion. The outer entrance of stately mansions ought also to be of enlarged dimensions, averaging from 6 to 12 feet in width, and of proportionate height; the inner entrance door may be from 4 to 6 feet in width, and placed in the central part of the building.

A door of the simplest kind, for out-houses, is made of boards rebated together; or ploughed and tongued, and nailed upon a cross piece called a ledge, from which it derives its name of ledge-door. Doors intended when closed to present an even surface, are called *jib-doors*, or *flush-doors*, and give an uniform appearance to rooms, or save the expense of corresponding doors. To combine durability with beauty, in doors, they are constructed of framed work enclosing panels, which are fitted into grooves in the edges of the frames, which are joined together by mortise and tenon. The three horizontal pieces mortised into the upright sides of the door, are called the *top*, the *bottom*, and the *lock-rails*; and if a fourth occur under the top-rail, it is called the frieze-rail: the side pieces are denominated *stiles*; the two intermediate pieces are called *meeting stiles*; and additional pieces between the stiles are called *munnions*. Framed doors are diversified by the number and different kinds of their panels. The panels of doors, when of the same thickness as the frame-work, are generally beaded; in which case they are fitted into the frame, and the whole smoothly planed; after which it is taken to pieces, and the edges of the frame-work are worked with the bead-plane. In doors with double margins representing two folding doors, the broad middle stile extends the whole length, and is inserted into the top and bottom rails by notches in the latter fitted to forked ends of the double middle stile. The *baize* door is covered with that material, to keep the cold air out of rooms. The *batten* door is almost exclusively appropriated to the stile of architecture called Gothic: boards grooved and glued together, form the ground on which stiles, rails, and munnions made of battens are nailed, to give the appearance of a framed door. If the battens be on one side, it is said to be singly, if on both sides doubly battened. In these latter, the stiles on each side are bolted together, which gives great strength to the work. The entrance gates of ancient British mansions were of this construction.

Those doors which are double are either *folding doors*, closing against each other, covered with baize, to prevent access of cold air; or they are *double margin doors*, formed of two door-frames, with a strong middle piece called the *staff-stile*, finished with the appearance of two inner stiles of folding doors.

The doors of the ancients were of stone, marble, wood, brass, or iron, and sometimes, in temples, of gold. They revolved on pivots, and were raised a little above the ground. The Roman doors opened inwards; those of the Greeks, outwards; the form of both was narrower at the top than the bottom, in consequence of which they shut of themselves. In his fourth book, Vitruvius gives rules for the construction of Attic, Ionic, and Doric doors.

Doors, marble. See *Carpentry*.

Doors to rooms ought to be in the middle, and, in suits of rooms, exactly opposite each other; in bed-rooms, they should never be beside the bed, nor, in other rooms, near the fire-place. Interior doors are usually ornamented with an architrave, which is sometimes surmounted with a frieze and cornice The ornaments of an exterior door are generally an entablature, with consoles, or pilasters, or attached columns, as supporters. It is of importance in the hanging of internal doors, to clear the ground-floor or carpet they open over. To effect this, either the door when hung must project an eighth of an inch at the bottom toward the room, or the jamb against which the door is hinged, must be an eighth of an inch out of the perpendicular, inclining toward the opposite jamb; or the upper hinge must be made to project an eighth of an inch further toward the door than the lower hinge, if the jamb be perpendicular. See *Hinges* and *Hinging*.

Door Frame, or *Case*. The wooden frame enclosing a door, which is joined together, wrought and beaded, or formed of architraves and linings, and called a door-case. See *Blank Door*, and *Architrave*.

Door-way. See *Atrium*.

Door Hinge. Door-hinge, an air-tight door-hinge, by Mr. Martin Furniss, 128, Strand, London, is described at large in the Transactions of the Society for the Encouragement of Arts for 1809, and in the Repertory of Arts, volume xiv. for the same year; and doors are made air-tight when shut, and fresh air admitted, as required, by a new and improved apparatus, invented by William Robins, of Saffron Walden, to whom a patent was granted in 1819. It is described in the Repertory of Arts, vol. xxxv. for 1819.

A double spring, for raising the door as it opens, and preventing the admission of air when shut, has been invented by Mr. White, of Laystall-street, London, and is described in the Transactions of the Society for the Encouragement of Arts for 1820, and in the Repertory of Arts for July 1820. The spring is under the axis of the door, which it raises as it opens; and whether the door opens inward or outward, the alternate rising and falling is the same; in either case, the greatest strength of the spring is exerted to close the door. An improvement has been made of this invention by Mrs. White, an account of which is given in the Transactions of the Society for the Encouragement of Arts for 1822, and in the Repertory of Arts for the same year, p. 163. The expense does not exceed 22*s.*

Another mode of rendering doors air-tight, and causing them to rise as they open, is by affixing a plinth of wood of three inches deep on the bottom of the door on the outside, by means of a pair of *butt-hinges;* this plinth is raised by a semicircular wedge or staple fixed in the floor opposite the hanging stile, and lifts up the plinth as the door opens. The invention is by M. Cauchois, and is described in the Repertory of Arts, vol. xxi. p. 371.

An efficacious mode of raising a door as it opens, turning on pivots, has been invented by Mr. Stone, of Warwick-street, Golden-square, London, which is described in the Repertory of Arts, vol. xxvii. for 1815, p. 45, and in the Transactions of the Society for the Encouragement of Arts for the same year; this is effected by means of a double spring. If pivots be used, the lower one may be a coarse screw, which will raise the door as it opens.

Door Latch. In the Transactions of the Society for the Encouragement of Arts for 1806, and in the Repertory of Arts, vol. ix. for the same year, p. 277, a description is given of an improved door-latch, as free as possible from friction; never requiring to be oiled, moving smoothly, and of very simple and easy construction; invented by Mr. Antis, of Fulneck, near Leeds, in Yorkshire.

Door Spring. A spring for closing doors, of simple construction, easy application, and not subject to be out of order, by Mr. E. Parker, of High Holborn, is described in the Transactions of the Society for the Encouragement of Arts, for 1818.

Dorah, al. See *Caaba.*

Doric Order. Of the three orders of Grecian architecture, this is the oldest and the most original. Mr. E. Aikin, who has written a learned and elegant treatise on the subject, observes, "In considering the buildings of antiquity, and particularly of Greece, the first circumstance that strikes us is their extreme simplicity, and even uniformity. The temples of Greece were invariably quadrilateral buildings, differing only in size, and in the disposition of the porticos, which either ornamented the front alone, or surrounded every side with their beautiful and shady avenue. The system of Grecian architecture is founded on the simple principles of wooden construction: a quadrangular area is enclosed with trunks of trees, placed perpendicularly, with regular intervals; these support lintels, upon which rest the beams of the ceiling, and an enclosed roof covers the whole. Such was the model; when touched by the hand of taste, the post and the lintel were transmuted into the column and entablature, and the wooden hut into the temple. It appears probable that the earliest Greek temples were really of wood, since so many of them were consumed during the invasion of Xerxes; and that large and magnificent edifices were sometimes principally of this material, is rendered evident by the example of the temple of Jerusalem, which was surrounded by columns of cedar. But builders soon adopted the more noble and durable material of stone; and though the general system of architecture was already established, its forms received some modifications by being thus, as it were, translated into a new language. A wooden lintel, from its fibrous texture, possessing considerable tenacity and strength in proportion to its weight, it was practical to form very wide intercolumniations; thus we are told by Vitruvius, that the ancient Tuscan temples were constructed with wooden architraves. Stone, on the other hand, of a granular composition, and of great specific gravity, would break by its own weight, in a bearing where a timber beam would be perfectly secure. When, therefore, porticos were erected of stone, it was necessary, in order to secure solidity, to contract the distance between the columns to very narrow limits. A wooden edifice, never secure from the injuries of accident or violence, presented no motive for any great solidity in its construction. But in stone it is possible, as the energetic industry of the Egyptians has demonstrated, to defy the injuries of time, and almost the violence of rapine. The architect who builds in stone, may build for eternity; and this idea will give a motive for that grand and massy solidity so essential to the sublimity of architecture. These circumstances led to the perfection of the Grecian style; the original model secured simplicity of form and construction, while the superior material preserved it from the meagreness attendant on wooden buildings. Thus arose the Doric, or, as it might be emphatically called, the *Grecian* order,—the first-born of architecture, a composition which bears the authentic and characteristic marks of its legitimate origin in wooden construction, transferred to stone. In contemplating a capital example of this order, as, for instance, the Parthenon at Athens, how is our admiration excited at this noblest, as well as earliest invention of the building art! What robust solidity in the column! What massy grandeur in the entablature! What harmony in its simplicity! not destitute of ornament, but possessing that ornament alone with which taste dignifies and refines the conception of vigorous genius; no foliage adds a vain and meretricious decoration, but the frieze bears the achievements of heroes; while every part, consistent in itself, and bearing a just relation to every other member, contributed to that harmonious effect which maintains the power of first impressions, and excites increasing admiration in the intelligent observer. So, in the immortal statue of Glycon, the form of heroic vigour is crowned with beauty, dignity, and grace. Other orders have elegance, have magnificence, but sublimity is the characteristic of the Doric alone.

The temple of Juno, at Argos, is said to have been the first Doric erection, considered as a specimen of the order, built when Dorus the son of Deucalion, the first king of the Dorians, reigned in the Peloponneus; but we are informed by Vitruvius, that its form and symmetry were not determined till Ion, the nephew of Dorus, led the Ionians into that part of Asia Minor, to which his name was afterwards given. The columns of the temple he there built, were six diameters in height—the proportion the human foot bears to the height of the body; they were fluted, to serve the purpose of resting spears against. The whole height of the order, including the pedestal, is 12⅓ modules, reckoning the module a whole diameter. The pedestal is 32; the base, shaft, and capital 8, and the whole entablature 2 modules. Dividing the large diameter into 60 parts, called *minutes*, 30 are given to the base, 30 to the capital, 30 to the architrave, 45 to the metope, and 45 to the height of the cornice, including the upper fillet, or capital of the triglyph. When the mutules are introduced in the entablature, one module is assigned to the projection of the cornice, which in this respect exceeds any of the other orders. The projection of the mutules is equal to their width, being 30 minutes: the width of the triglyphs is exactly the same, and their distance from each other equal to the height of the metope, which by this division forms a perfect square. The sides of the channels of the triglyphs are at right angles with each other. The intercolumniation of this order is attended with difficulty, arising from the strict regard that is always paid to the due width of the triglyph, and the perfectly square form of the metopes or their intervals. Besides, it is absolutely requisite, that a triglyph should be placed exactly over the centre of every column. For these reasons, the mutules and triglyphs have been omitted in capital works, both ancient and modern, as in the Coliseum at Rome, and the Royal Hospital at Greenwich. Palladio has given an instance of an ancient temple with angular triglyphs; which reduces the intercolumniations of the two angular columns to one diameter and a quarter, which is less than the pycnostyle. The next intercolumniation is still greater, approaching near to the periostyle, as it is evidently necessary to bring the triglyph over the centre of the third column from the angle. The next, which is the centre intercolumniation, and faces the entrance of the temple, is rather more than eustyle, or two diameters and a quarter; and has, in the metopes, ditriglyph. But the intervals between the triglyph are much too narrow for their height, so as to produce an unfavourable effect. The other spaces are monotriglyph, and are perfect. The regular intercolumniation of the Doric order, is the monotriglyph, or pycnostyle, which admits of one between two columns. The ditriglyph, or eustyle, admits two; and the areostyle is triglyph, or consisting of three; but the most perfect of these is the ditriglyph.

When capitals and bases of coupled Doric columns have their proper projections, and are at any distance from each other, the metope between them will be rather too wide; but that may be avoided, by confining the projections, or making the triglyph one minute more than it should be, and placing its centre a minute within the axis of the column, which trifling difference will not be perceived without the nicest examination. In small buildings, such as ornamental temples for gardens, strict regard to the rules for distances need not be attended to; always, however, observing that such works must have an interval, that will admit an easy passage between the pillars. Doric arches without pedestals, are seven diameters and three-fourths high; and in width four diameters and fifteen minutes. The piers are two modules in front, and in thickness one module, twenty-two and a half minutes; or in proportion to their distance from the wall. From centre to centre of each pier is six diameters and fifteen minutes. Arches of this order, with pedestals, have their apertures, in height nine diameters and thirty minutes; and in their width five diameters, fifteen minutes. The piers are two diameters and fifteen minutes wide in front; and from centre to centre of each is seven diameters and fifteen minutes.

The distinguishing characteristic of the Doric order is the want of a base. The flutings are few, large, and very little concave. (See *Flutings.*) The capital has no astragal, but only one or more fillets, which separate the flutings from the torus. Amongst the finest ancient monuments of the Doric order may be named the ruins of Pæstum. The temples of Minerva and of Theseus, as well as the Propylæa at Athens; those of Juno, of Hercules, and of Concord at Agrigentum; those at Segesta and Selinus in Sicily; that of Coza, and that of Minerva, at Syracuse. The proportions of the Doric column, in the ancient monuments which remain, are much shorter than those adopted by the moderns, its mean proportion being about four diameters and a half. The proportions were first altered by the Romans, amongst whom this Doric order lost many of its characteristics. Amongst the remains of Roman Doric buildings may be cited the quarters of the soldiers at Pompeia, the tomb of Terracina, the baths of Diocletian, the theatre at Vicenza, a triumphal arch at Verona, the theatre of Marcellus, &c. Specimens of Doric columns are given from temples of German workmanship, in *Doric Order*, pl. II. Pl. I. exhibits the parts and proportions of the Doric Capital. See *Capital.*

DORIC PORTICO. See *Athenian Architecture.*

DORIC TEMPLE. See *Ægesta.*

DORMANT, or DORMER WINDOW. The attic stories of houses were in former times, generally occupied as sleeping rooms, and the windows opened on the inclined plane of the roof; on this account the rooms were called *Dormitories,* and hence the appellation of *dormant,* applied to the windows of these apartments.

DORMITORY, a sleeping room. See *Abbey.*

DOUBLE VAULT. There is a vault in St. Peter's at Rome, enclosed by a duplicate wall; and wine cellars are sometimes so formed, to enclose a surrounding body of cold air.

DOVE-HOUSE, see *Columbarium.*

DOVE-TAILING; a mode of fixing two boards together by indentures in the one, and projections in the other of the shape of a dove's tail. See *Joinery.*

DRAGON - PIECE, the name given to a piece of timber joined to what is called, in roofs, the *diagonal tie.* See *Angle Brace.*

DRAIN, or SEWER. A passage for water to pass off from houses or towns; formed under-ground, and sometimes of very extensive dimensions in cities; necessary to convey away not only superfluous water, but impurities of every description. In all places subject to dampness, it is of great importance to make drains before buildings are erected; but a situation in some degree elevated, and naturally dry, is to be preferred. See *Arch,* and *Air-trap.*

DRAUGHT, or DRAWING. Architectural composition or design is understood to be a necessary mode of conveying instructions to the practical builder and the workmen, by exhibiting a comprehensive view of a projected building; drawings for this purpose must be executed with clearness and precision, conformable to a regular scale of proportions. Plans, elevations, and sections are to represent the internal features of the apartments, halls, passages, and various arrangements for ornament or convenience, and the external façades, porticos, domes, and other outward appendages. Drawings of the smaller parts of an edifice will be required, numerous in proportion to their extent and variety of form. Where the façades of a building differ considerably, elevations of each of them will be required; and more than one general view of the projected building will be necessary, to give complete satisfaction to the proprietor.

Draught Compasses, have moveable points, peculiarly useful in forming the fine lines in architectural drawings. See *Mathematical Instruments.*

Draw-bore Pin, a joiner's tool, of a solid piece of steel tapering from the handle; used for the purpose of enlarging the pin-holes which are to secure a mortise. When this purpose is effected by the driving in of the draw-bore pin, the wooden pins are immediately inserted.

Draw-bridge, a bridge made to draw up or let down, admitting or rejecting communication at pleasure; much used in fortified places. They are commonly made with plyers twice the length of the gate, and a foot in diameter. The inner square is traversed with a cross, which serves as a counterpoise; and strong chains of iron hang from the extremities of the plyers, to let down or lift up the bridge. In navigable rivers it is sometimes necessary to make the middle arch of bridges with two moveable platforms, to be raised occasionally, in order to let the masts and rigging of ships pass through.

Drawing Room, sometimes with greater apparent propriety, called the *withdrawing room*, in noblemen's houses and splendid mansions, is a large and elegant apartment into which the company *withdraw* after dinner.

Dressing, is the operation of squaring and smoothing stones for building, by the hammer and mallet, called hammer-dressing; or further by afterwards rubbing the outward face smooth. See *Masonry*, and *Stones.*

Dressing Room, an apartment contiguous to the sleeping-room, for the convenience of dressing; having usually an entrance door from without, for the admission of the valet.

Dressing. Ornamental projections from walls, of various descriptions, receive this appellation; as also the architraves, borderings, and facings of doors and apertures.

Drift, applied to arches, and synonymous with the term or phrase *shoot* and *thrust*, intended to express the powerful impetus of the arch against the pier, caused by the slanting position of the courses of which it is composed; it is kept from falling by the resistance of the abutments.

Drip, a name given to the member of a cornice, which has a projection beyond the other parts, and a form adapted to the purpose of throwing off water by small portions, or *drop* by *drop*; it is also called the *Larmier*.

Dripping Eaves are the terminating projections of inclined roofs of houses, to which there is no gutters adapted for carrying away the water, which, therefore, falls into the streets. The building act prohibits this description of eaves in London.

Dromos. An enclosed entrance to ancient buildings.

Drops, (*guttæ*, Lat.) are ornaments of a conical form, hanging, drop-like, in the cornice of the Doric order, below the mutules, and on the architrave under the triglyphs, six under each. Drops of a conical form are peculiar to the Roman Doric; those of the pure Doric being more or less inclined to the cylindric form.

The drops in the cornice of the Doric portico at Athens are not much more than one-fourth of their diameter in height; but those of the epi-style are more than half their diameter in height.

Droved Ashler, the coarsest kind of hewn stone for building. See *Masonry*.

Droved and stripped. A series of grooves an eighth of an inch deep, cut with a three-quarter-inch chisel, leaving a droved space between each, constitutes the hewn variety of building stones to which this name is given; a sort common in Scotland, but not used in England.

Druidical Architecture. Some observations have been already given, under *Celtic Architecture*, on the domestic buildings of the ancient Britons, the present article will, therefore, be principally devoted to their religious and sacred edifices. Various remains of the ancient Druidical buildings are found scattered over different parts of England and Wales, and form interesting objects of antiquarian research. Some of the most remarkable monuments of the Druids are the circles of unwrought upright stones, commonly recognized under the name of Druidical Temples. They are usually found in elevated situations, and one structure often consists of several circles, either concentric, lateral, or in some other mode of disposal, indicating an attention to mathematical regularity of arrangement. They are found in Cornwall, (where the principal are denominated the *Hurlers*,) in Cumberland, (*Long Meg and her Daughters*,) Derbyshire, Devonshire, Dorsetshire, Oxfordshire, (*Rollrich*,) Somersetshire, (*Stanton-Drew*,) Westmorland and Wiltshire, (*Avebury* and *Stonehenge*.) They are very common in Wales, and are frequently found in the Western Isles. It is remarkable that they are also found in Iceland, Norway, Sweden, Denmark, and various parts of Germany. Amongst other arguments for the great antiquity of these monuments in Britain, it is observed, that in some instances they are crossed and injured by Roman ways. Circles of stone appear indeed to have been used in the performance of religious and judicial ceremonies, by the most remote nations of antiquity, and, under the prevalence of that similarity of manners, which may be traced between nearly all countries in the infancy of society, they were probably constructed by the earliest ministers of the Druidical religion. These circles are frequently found to have been surrounded by a ditch and a vallum, the latter forming the boundary, or being on the outer side. The number of stones is far from uniform, and in some instances it is not more than nine. In the circle called Grey Yards, in Cumberland, there are eighty-eight. The following sketch of the plans most prevalent among these circles is condensed from Borlase. — Their figure is either simple or compounded. Of the first kind an exact circle, elliptical or semicircular. The construction of these is not always the same, some having their circumference marked with large separate stones only; others have ridges of small stones intermixed, and sometimes walls. Others have their figure more complex and varied, consisting not only of a circle, but of other distinguishing properties. In or near the centre of some, stands a stone taller than the rest; in the middle of others is a cistvaen, whilst a cromlech distinguishes the centre of some circles. Some have only one line of stones in their circumference, and others two; some circles are adjacent, some contiguous, some include, and some intersect each other; urns, skeletons, and other funeral deposits, are found in or near them. Some are curiously erected on geometrical plans, the chief entrances facing the cardinal points of havens. Some have avenues leading to them, placed exactly north and south, with detached stones, sometimes in straight lines to the east and west, sometimetriangular. The principal works which treat on these circles, are Borlase's Antiquities of Cornwall; Rowland's Mona Antiqua; Dr. Stukeley's Works; King's Munimenta Antiqua; Sir R. C. Hoare's Ancient Wiltshire; Polwhele's History of Devonshire.

One of the most extraordinary Druidical circles in Britain, is that of Stonehenge, in the middle of a flat area, near the summit of a hill, six miles from Salisbury. It is enclosed by a circular double bank and ditch near 30 feet broad, after crossing which we ascend 30 yards before we reach the work. It consists of two circles and two ovals. The outer circle is about 108 feet in diameter, consisting, when entire, of 60 stones, 30 uprights and 30 imposts, of which only 24 uprights remain, 17 standing, and seven down, and eight imposts. They are three and a half feet asunder. Eleven uprights have their four imposts upon them by the grand entrance. These stones are from 13 to 20 feet high. The lesser circle is somewhat more than eight feet from the inside of the outer one, and consisted of 40 lesser stones, the highest being six feet: 19 remain, of which 11 only are standing. The *Adytum* or cell is an oval formed of 10 stones, from 16 to 22 feet high, in pairs, with imposts, which Dr. Stukeley terms *trilithons*, and above 30 feet high, rising in height as they go round, each pair separate, and not connected as the outer pair. Within these are 19 more smaller single stones, of which only six are standing. At the upper end of the *Adytum* is the altar, a large slab of blue coarse marble, 20 inches thick, 16 feet long, and 4 broad; pressed down by the weight of the vast stones that have fallen upon it. The whole number of stones, uprights, imposts, and altars, is 140. The heads of oxen, deer, and other animals, have been found on digging in and about Stonehenge, and there are numerous barrows in its immediate neighbourhood. There are three entrances from the plain, the most considerable of which is from the north-east, and at each of them were raised, on the outside of the trench, two huge stones, with two smaller within, parallel to them.

Other Druidical monuments are *Logan*, or *Rocking Stones*; these are stones generally of immense bulk and weight, placed on so small a centre, and in so exact an equilibrium, that it moves to a certain degree with the application of a very small power, as the touch of the hand, but which could not be thrown down by any common force. They are found in Cumberland, Cornwall, &c. Others from their form are denominated *Rock Idols*, and *Tollmen*. The hollow indentations often found on rocks, &c. in Cornwall and Derbyshire, and sometimes bearing evident marks of being artificial works, are called *Rock-basins*, and are supposed to have been used by the Druids. The *Cromlech* is a rude monument, consisting of several huge upright stones, which act as supporters to a stone placed nearly horizontally. The number of upright stones is sometimes three and even six, and in a few instances more. The stone at top is generally of a swelling form, approaching to convexity, and they are often found on *Carnedds*, or artificial hillocks of loose stones. —They are found in various parts of England. They are supposed by many to have been used as altars. On a subject like this, tradition is often worthy of notice. A cromlech in the midst of a circle of stones, in the isle of Arran in Scotland, is asserted by the thinly spread and stationary inhabitants of that lonely district, to have been the place "on which the ancient inhabitants burnt their sacrifices in the time of the heathens." See Martin's Descriptions of the Western Isles, p. 220.

In many parts of England and Wales, are high and massy stones, in an erect position, either single or two or three together, and considered as monuments erected by the ancient Britons in commemoration of some great event which happened there. At Rudston, in the East Riding of Yorkshire, is a single stone of this kind, twenty-four feet high, five feet ten inches broad, and two feet three inches thick. There are three stones near the village of Trelech, in Monmouthshire, of which the lowest is ten, and the highest fifteen feet. They are called by the natives Harold's stones. In the same parish is a remarkable tumulus, called Cryg y Dyrn, sixty paces in circumference, and six yards high. It is chiefly composed of small stones covered with turf, and may properly be called a *carnedd*. Upon the top is a large flat stone of an oval form, three yards long, and twelve inches thick. Under it was found a cist-vaen, or stone chest, four feet long, and three broad, composed of seven stones. It is supposed to be the burial-place of some British chief before the Roman invasion. In the same village are the remains of an entrenched camp. These monuments appear in many instances to have been looked on by the Britons with superstitious veneration.

Tumuli or *Barrows* are found in various parts of England and Wales, and vary much in shape, size, and situation. Some of the most curious occur in Cornwall, Derbyshire, Dorsetshire, Hampshire, Lincolnshire, Kent, and Wiltshire. Sir R. Colt Hoare, in his History of Ancient Wilts, distinguishes them into the following classes. The most ancient kind appear from their contents to be those he terms *Long Barrows*, which, he says, "differ considerably in their structure as well as dimensions; some of them resemble an egg cut in two lengthways, and the convex side placed uppermost; some are almost of a triangular form; whilst others are thrown up in a long ridge, of nearly equal breadth at each end; but we find more generally one end of these barrows broader than the other, and that broad end pointing towards the east." They are generally found on elevated spots, and single; and sometimes one of them is found in the midst of a group of others. The *Bowl Barrow*, is so called from its obtuse rotundity of form, and is sometimes surrounded by a slight ditch. The *Bell Barrow* "from its elegance of form seems to have been a refinement on the bowl barrow." The *Druid Barrow* was supposed, by Dr. Stukeley, to have belonged to the ministers of religion, but Sir Richard has strong reason for supposing that it was appropriated to females. The outward vallum, with the ditch within, is most beautifully moulded: in the area are sometimes two or three mounds, which often contain small cups, &c. The *Pond Barrow*, resembles an excavation made for a pond. being circular, and surrounded by a vallum, the area being perfectly level. The *Twin Barrow*, has two tumuli enclosed within the same circle, and is of rare occurrence. The small *Cone Barrows*, are generally found on commons and moors, seldom exceed thirty-three feet in diameter, and are raised of earth, and generally surrounded with a narrow trench. The cist in which the body was placed is found at unequal depths. The *Broad Barrow*, is broader and flatter than the bowl barrow, which it otherwise resembles. Of the tumuli which are composed of loose stones, and called *Carnedd* or *Cairns*, Silbury Hill is a remarkable specimen, being 560 feet in diameter at the base, 105 at the top, and 170 in perpendicular height. The smallest are not more than 13 feet in diameter.

Drum, the solid part of the capitals of the Corinthian and Composite orders; from its form called the *vase*.

Drymaia. See *Acropolis.*

Dry Rot. See *Air-holes and Timber.*

Ducts of water. See *Aqueduct.*

Dumhæta tombs. See *Abyssynian buildings.*

Dun, or Burgh, the name of an ancient species of buildings, of circular form, common in the Orkney and Shetland Isles, the Hebrides, and the northern parts of Scotland. *Borg* is a Swedo-Gothic word; and the Highlanders universally apply the Celtic name *Dun* to these towers. They are, with few exceptions, confined to the countries once subject to the crown of Norway, and generally built within sight of the sea. One of the most perfect of these erections is at Glenby, and is described by Mr. Pennant, in his voyage to the Hebrides—"It is placed about two miles from the mouth of the valley; the more entire side is about thirty feet six inches in height, and was some years ago about ten feet higher. The whole structure seems to have been of a conical form outwardly, but internally the surrounding wall is perpendicular; so that it must have been much thicker at the bottom than the top. The enclosed circular area is thirty-three feet and a half in diameter; it is constructed of flat stones neatly placed one upon another, without any cement or mortar; and at ten feet from the ground, found to be seven feet four inches thick; and within this thickness were two surrounding galleries; one quite in the lower part of the tower, about six feet two inches high, and two feet five inches wide at the bottom, but made narrower at the top, and flagged and covered with great flat stones. The other gallery is placed directly over this, having these flag-stones for its floor, and being only five feet six inches high, and only twenty inches at the bottom, but covered at top, like the other, with large flat stones. This upper gallery, in which a man could barely make his way, went quite round the tower, without any division or partition; but the lower gallery underneath this, is parted off into separate spaces, by great flag-stones placed upright, which several spaces, or little cells, were in general accessible only by means of holes in the floor or gallery above; so that nothing can be more obvious than that these cells were intended for the keeping and preserving of stores. Besides these galleries, there were, on the inside of the wall, open to the circular enclosed apartments, four perpendicular rows of small cavities, or, as they have been described by others, four stages, or nests, of small square open holes, dividing the interior circular wall into four parts, and turning up from the lower part of the tower to the top; each little hole or nest in the row divided from that beneath only by a sort of shelf or flag-stone, and forming a little cupboard. This appearance is similar to what is observable in another dun in the same neighbourhood, and seems to have been intended to hold the drinking horns and other utensils for banqueting in these rude dens.

Dwarf walls. The walls enclosing courts, above which are railings of iron; similar walls sometimes supporting the ground-floor of a building; and low walls in general receive this name.

Dwelling house. See *Building*, and *House*.

E.

Eagle, (*aigle*, Fr. *αιετος*, Gr.) a term used by the Greeks for the frontispiece or pediment of their temples. See *Ætos* or *Ætonia*. In describing the Propylæa at Athens, Wheler observes, "The *eagle* of the front was sustained by four pillars of the Doric order." In the Athenian inscription, brought to England by Chandler, and now preserved in the British Museum, the slabs which form the tympanum of the pediment are called *Αιεταιοι λιθοι*, which explains the expression of Pausanias, that the sculptures of the Parthenon were placed *αιετοις* in the eagles.

Earth Buildings. It appears from history, that before the Roman invasion the natives of Britain had no better habitations than those described by Tacitus; found also among the Germans. They were dug (he informs us) in the ground, and covered with earth. In these they stored their provisions; and into these they retired from the pursuit of their enemies, and in winter for warmth. Some earth-houses of this description are yet to be seen in the Western Isles of Scotland, and in Cornwall. In modern times various modes of building houses, with baked or dried earth, have been adopted; and unburnt brick have also been used: in either case, the walls must be preserved from the weather by a covering of waterproof cement. In February, 1813, a patent was granted to Joseph Hamilton, for certain methods of constructing and connecting earthen building materials. These the patent describes as consisting of lumps, bricks, or masses, and being perforated with holes for the purposes of fastening together by pins or bolts, with or without mortar or cement; the former mode being always to be preferred; and as an improvement peculiar to the patent, moveable air-furnaces are successively placed in various parts of the walls, by which the most important are soldered or vitrified together. — *Repertory of Arts*, 1815, vol. xxvi.

Eating Room. See *Abaci* and *Dining Room*.

Eaves, (*efese*, Sax.) the overhanging edges of a roof. Gutters were generally made by the ancient architects above the extremity of the eaves, in the upper part of the cymatium: they were ornamented, as in the Erectheium, by the ends of the joints, which extended from the ridge to the eaves. In the inscription mentioned in the article *Eagle*, which relates to the building of this temple, their ornamented eaves or joint-stones, are termed *γογγολοι λιθοι*, which is supposed by Mr. Wilkins to be the upright circular pieces, which terminate the joint tiles at the eaves or gutters. Sometimes the water was thrown off through the mouths of lions' heads, sculptured in the cymatium, and sometimes the circular ornament on the eaves was formed of potter's clay, where it was called *στογγυλοειδης*, or *γογγυλοειδης κεραμος*. The joint-tiles are called in another part of the inscription *ἁρμοι*; the eaves being first placed, the tiles, and the other rows in succession up the ridge, the *ἁρμοι* were laid in the same order of succession above each other. The tiles at the eaves were formed in the top bed of the cornice behind the upper fillet of the cymatium, in blocks twice the length of the other tiles.

Eaves Lath, called also *Eaves Board*, and *Eaves Catch*, an arris fillet, or thick feather-edged board, at the eaves, to raise the bottom of the first course of slates, above the sloping plane of the side of the roof, that the next course may be properly bedded.

Ecbatana, the ancient metropolis of Media, the origin of which is ascribed by Diodorus Siculus to Semiramis. All we know of its extent and buildings is collected from the exaggerated accounts of ancient writers, as there are no traces left of it, and its site is become a subject of dispute. Chardin fixes it at Tauris, others at Hamedan, and some at Gasbin, in the province of Yerrack.

Eccentricity, having a different centre from another circle; the distance between the foci of an ellipsis.

Ecfou, a considerable village of Egypt, on the Nile, in Lat. 24° 58′ 43″ N.; Lon. 32° 54′ E.; the site of the ancient *Apollinopolis Magna*. At the north-west corner of the village, and on the highest ground, stands a magnificent temple. Numerous brick huts have been erected at the top of the temple, in the peristyle, and in front of the propylon, so as to render it difficult of access. The propylon is in the form of a truncated pyramid, and is at once the most imposing, and one of the best proportioned in Egypt. From a base 90 feet in length by 30 feet in width, it rises up on each side of the gateway, like two square towers, without embrasures, gradually narrowing, till, at the height of 100 feet, it measures on the flattened top only 75 feet by 18 feet. Handsome stairs lead from the gateway on either hand to the different chambers, and to the summit. Over the entrance is the globe with the serpent and wings, and on each side is sculptured on the wall a colossal figure of Isis, attended by the hawk-headed deity, and another colossal figure armed with a hatchet. Within the propylon is an open court, or *dromos*, enclosed with high walls covered with sculpture, and adorned with a peristyle of eleven columns, besides five on each side of the doorway, all covered with sculpture. The pronaos, at the northern end of the court, has six columns in front, with varied capitals, resembling the leaf of the *doum*, or Thebaic palm, the leaf of the date-tree, and the budding lotus. The winged globe and serpent occur again over the door, and are frequently repeated on each side, with other strange devices of beetles, long-tailed monkeys, &c. A moulding passes down the corners of the temple, the same as at Dendera and Esneh, so as to include the whole in a frame. Within the pronaos are two rows of columns, three in each row, loaded with hieroglyphics and devices; the globe with wings is painted along the centre of the ceiling, and each intercolumniation has its peculiar ornament. On the walls, Osiris, Isis, and Orus, are receiving offerings. The entrance to the cella is quite blocked up with sand and rubbish. The exterior of this beautiful temple is covered with similar decorations, but the figures are larger and less numerous. The whole has been surrounded with a high stone wall, at once to exclude the unhallowed gaze, and to protect the sanctuary from violence; but it is now banked up with rubbish. The temple measures about 440 feet by 220 feet, and its largest columns are 21 feet in girth, and 42 in height. On a lower level, a little distance to the south-west, stands a small peripteral temple, supposed to have been dedicated to Typhon, whose terrible image occurs above the capitals of the columns, and on the walls. The cella of this temple is also filled up with sand.

Echea, (ηχεα, Gr. from ηχεω, I sound,) sonorous bell-shaped vases of bronze, or earth, used in the construction of ancient theatres, to give greater power to the voices of the actors. They were arranged between the seats in niches made for the purpose, their size being proportioned to the magnitude of the building, and their conformation such that they returned all the concords from the fourth and fifth to the double octave. Vitruvius tells us, that the vases of the theatre at Corinth were transported to Rome by Mummius. In the choir of the Gothic cathedral of Strasburgh, formerly belonging to a monastery of Dominicans, Professor Oberlin discovered similar vases in various parts of the vaulted ceilings, which appeared to have been placed there for the same purpose.

Echinus, (εχινος, Gr.) a convex moulding, generally ornamented with spheroids or eggs; the upper ends cut off, the upper part of the axis projecting, and the lower receding. Each egg is surrounded by a border, and is rather more than a semi-ellipsis. Every two adjacent borders contain a space equalling the thickness of the border at top, and gradually receding towards the bottom; and in each recess or space is an anchor or tongue. The Roman echinus, which is the quarter of a circle, or an ovolo, is much inferior to the echinus of the Greeks. In a column, the echinus is only used in the entablature or capital; and in the Doric order it is always plain, whilst in the Ionic and Corinthian it is generally carved.

Echo, (from ηχος, Gr. sound,) certain kinds of vaults and arches, generally of the elliptic and parabolic figures, used to redouble sounds, and produce artificial echoes. To an architect it is very requisite to know the principles of their construction. An echo is a reflection of sound striking against some object, as an image is reflected in a glass. Caverns, grottos, mountains, and ruined buildings, generally return the image of sound. At a ruined fortress near Louvain, in Flanders, there is a very remarkable echo, at which if a person sing, he only hears his own voice without repetition, whilst those who stood at a distance heard the echo, but not the voice; the echo too is attended with extraordinary variations, being sometimes louder, sometimes softer, sometimes nearer, and sometimes more distant. A similar echo, near Rouen, is described in the Memoirs of the French Academy. As every point against which the pulses of sound strike becomes the centre of a new series of pulses, and sound describes equal distances in equal times; therefore, when any sound is propagated from a centre, and its pulses strike against a variety of obstacles, if the sum of the right lines, drawn from that point to each of the obstacles, and from each obstacle to a second point, be equal, then will the latter be a point in which an echo will be heard. Hence all the points of the obstacles which produce an echo, must lie in the surface of the oblong spheroid, generated by the revolution of the ellipse round its major axis. As there may be many spheroids of different magnitudes, so there may be several different echoes of the same original sound. As there may also be a great number of reflecting points in the surface of an exterior spheroid than in that of an interior, a second or third echo may be much more powerful than the first, provided that the superior number of reflecting points, that is, of reflected pulses propagated to the ear, be more than sufficient to compensate for the decay of sound which arises from its being propagated through a greater space. In the celebrated echoes of the Lake of Killarney, in Kerry, the first return of the sound is much inferior in strength to those which immediately follow.

For the most powerful echo therefore, the sounding body should be in one focus of the ellipse, which is the section of the echoing spheroid, and the hearer in the other. An echo may be heard in other situations, but not so favourably as a person often hears the echo of his own voice, in which case, however, he must stand at least sixty-three or sixty-four feet from the reflecting obstacle. We commonly speak about three syllables and a half, or seven half syllables, in a second: that the echo therefore may return just as soon as these syllables are expressed, the distance of the speaker from the reflecting object must be half of 1,000 feet; for, as sound describes 1,142 feet in a second, six-sevenths of that space, that is, 1,000 feet nearly, will be described, while six halfs, or three whole syllables, are pronounced; that is, the speaker must stand nearly 500 feet from the obstacle. In churches we never hear a distinct echo of the voice, but a confused sound, because the greatest difference of distance between the direct reflecting courses of such a number of pulses as would produce a distinct sound, is not in any church equal to 127 feet, the limit of echoes. But the reflecting surface may be so formed, that the pulses which come to the ear after two or more reflections, may, after having described 127 feet or more, arrive at the ear in sufficient numbers, and so nearly at the same instant, as to produce an echo, though the distance of the reflecting surface from the ear be less than the limit of echoes. There is a singular example of this in a grotto on the banks of the brook Dinan, two miles from Castleamber, in the county of Kilkenny. As you enter the cave, and continue speaking loud, no return of the voice is perceived, but on asriving at a certain point, which is not above fourteen or fifteen feet from the reflecting surface, a very distinct echo is heard. This echo cannot arise from the first course of pulses that are reflected to the ear, because, from the small breadth of the cave, they would return too quick to cause a sensation distinct from the sound, it must therefore be produced by those pulses, which, after having been reflected several times from one side of the grotto to the other, and having run over a greater space than 127 feet, arrive at the ear in considerable numbers, and not more distant from each other in point of time than the ninth part of a second.

Whispering Galleries are constructed on similar principles. The form of this gallery must be that of a concave hemisphere, as ABC, (*Plate*, ATHENIAN ARCHITECTURE, A 4,) and if a low sound or whisper be uttered at A, the vibrations expanding themselves every way will impinge on the points DDD, &c. and from thence be reflected to EEE, and from thence to F and G, till they all meet in C, when the sound will be most distinctly heard. In the whispering gallery in the dome of St. Paul's, the ticking of a watch may be heard from side to side, and a very easy whisper be sent all round the dome. The whispering gallery of Gloucester Cathedral is a gallery round the east end of the choir, leading from one side to the other, consisting of five angles and six sides, the most central of which is a naked window: two persons may hear each other whisper at the distance of twenty-five yards.

ECPHORA, (εκ, out, φερω, I bear, Gr.) a word used by Vitruvius, (lib. iii. c. 3,) to signify the projecture of the member or moulding of a column, that is, the distance of its extremity from the naked of the column, or, according to others, from the axis.

ECTYPE, (εκτυπον, Gr.) an image in relievo, or embossed.

EDDYSTONE LIGHTHOUSE. The Eddystone rocks, which receive their name from the number of contrary currents which they cause, are situated nearly south-south-west from the middle of Plymouth Sound, 14 miles from the port, and 12¼ from Ram Head, the nearest land, in Lon. 4° 21′ W. Lat. 50° 3′ N. Lying nearly in the direction of vessels coasting up and down the channel, they were very perilous to ships before the erection of the lighthouse. For some time the erection of such an edifice upon the Eddystone rocks was considered as next to impossible, from the terrible swell that broke over them. In 1696 the first lighthouse was begun on the principal rock, which is the only one above water, by Mr. Henry Winstanley, and completed in 1700. But it was entirely destroyed, together with its founder, who, in his confidence of the stability of the building, had trusted himself in it, in a dreadful storm on the 27th of November, 1703. A wooden lighthouse of a different construction was erected by Mr. John Redyard in 1709, which was destroyed by fire in 1755. The present stone building was begun by Mr. John Smeaton in 1757, and finished on the 14th of August, 1759. The foundation-stones are dovetailed, and firmly united by a strong cement to the rock, which slopes towards the south-west, and is cut into horizontal steps. The external part of the work is of granite, and the internal of Portland stone; for it was found inconvenient to use either one or the other entirely, as the latter is subject to the depredations of a marine animal, and the working of the other was found too expensive. To the height of thirty-five feet from the foundation, the whole is a solid mass of stones engrafted into each other, and united by every kind of additional strength. Above are four rooms, and at the summit a gallery and lantern. The stone floors, which are flat above and concave below, are kept from pressing against the sides of the building, by a chain let into the walls. It is nearly eighty feet high, has withstood the most violent storms without injury; and probably, as its builder asserted, nothing less than an earthquake can overturn it.

Edging, the reducing the edges of ribs or rafters, that they may range together. See *Backing of a Rafter.*

Edile, (*Ædilis*, Lat.) a Roman officer, who was so named, according, to Varro, (lib. iv. de Lingua Latina,) "quod ædes sacras, et ædificia publica procuraret." His duty was to see that temples, houses, conduits, streets, and highways, were kept clear, safe, and in good repair, having under him proper executive officers, as quæstors, curators, &c.

Edifice, (*ædificium*, Lat.) is synonymous with the terms building, fabric, erection; but the word edifice is more strictly applicable to architectural erections distinguished for grandeur, dignity, and importance.

Effect, considered in architecture as the result of the sensations which the whole and the parts of an edifice together ought to produce on the mind and the eye, is difficult to appreciate from simple designs. Nothing is more deceptive than the simple delineations which architects make of their works. An architect must have great experience of effect, to judge of it from a delineation on paper; and even this experience will sometimes fail. Therefore in works of importance, architects generally make small models in relief, which give some idea of the play of light, and of the proportion of the different projecting parts to each other, and to the whole edifice. When Michael Angelo was commissioned by Paul III. to finish the Palais Farnese, of which Sangallo had finished the exterior as high as the entablature, he was not content with making a small model of the entablature, but he caused to be executed, on the angle of the palace itself, a model of the size which it was intended to be. Doubtlessly we cannot proceed thus with all edifices, and in all parts, but there are some parts, and the entablature and crown are of this number, in which the proof of a small model is insufficient to assure a good and just effect.

Egg and Tongue are ornaments sculptured in the echinus and Ionic volutes. It is traced back by M. Quatremere de Quincy to be the head of Isis, and represents, he thinks, a mystical collar or necklace of the mundane egg, and the tongue of the serpent of immortality. The egg has been from time immemorial among the ancients the symbol of the Being who created all things, and hath all things within himself. In the hieroglyphics of Egypt, and in the mysterious rites of Mithras, it is a symbolical figure of frequent occurrence.

Egyptian Architecture. In Egypt we have decided and abundant specimens of the earliest style of architecture, carried to its greatest perfection. Its characteristic feature is colossal dimensions. The tremendous size of the blocks employed, the great distance from which many of them are said to have been brought, and the art necessary to raise them to their elevations, appear works of superhuman labour. The buildings of the Egyptians are characterised by solidity of construction, originality of conception, and boldness of form. The light and elegant buildings of Greece and Rome were calculated to enchant and dazzle the eye, but the vast size and heavy proportions of the buildings of Egypt, strike the mind at once with astonishment and awe. The characteristic of their temples, is the immense volume of their masses; their exterior being usually composed of solid walls, which generally have an inclination to the pyramidal form, enclosing enormous columns in every variety of distribution. In the portico was introduced the most elaborate and magnificent workmanship. Two pyramidal walls rose up in front, pierced with doorways, the approach frequently adorned with obelisks, colossal statutes of deities, animals, sphynxes, &c. Their ornaments were entirely influenced by religion. The walls, the pillars, and the most sacred places of their religious buildings, were ornamented with hieroglyphics and symbolical figures, whilst the ceilings of the porticos exhibited zodiacs and celestial planispheres. The whole mass of their decorations were but a series of mysterious and allegorical inventions, to typify all the divine attributes and wisdom of the Creator. They constitute a suit of learning, moral precepts, and religious rites, embodied in forms; the organs through which they communicated all those sciences more immediately connected with the creation, and which developed the divine greatness and power. Every detail was subservient to some great ends, and was suggested by some urgent reason; every object spoke most intelligibly to the eye, to the heart, to the soul, of the beholder; the temples being the sacred treasuries of science as well as art. The priests, the great depositories of knowledge, were the exclusive designers of the religious edifices, they alone directed the taste of the architect and the sculptor, and they employed architectural grandeur, with all its accessories, to influence the minds of the people.

The earliest civilization and cultivation of the arts was in Upper Egypt; for the inhabitants of Lower Egypt, for a long time after architecture was known and practised among the former, lived in natural caves and excavations of the mountains. The most remarkable and most ancient monuments of the Egyptians, with the exception of the pyramids, are nearly all included in Upper Egypt, from the frontier of Ethiopia or Abyssinia to Manfelut in the north, in the islands of Philoe and Elephantina, at Kaum Ombou, Esneh, Etfu, Medinet Abu, Dendera, and Girgé.

The temples of Egypt were generally without roofs; consequently the interior colonnades had no pediments, supporting merely an entablature, composed sometimes of only architrave and cornice, sometimes architrave, frieze, and cornice, formed of immense blocks, united without cement, and ornamented with hieroglyphics, zodiacal signs, and religious processions. The same kind of decoration also frequently occurs, which was imitated by the first Grecian architects, and distinguished by the name of triglyphs and metopes, the chief characteristics of the Doric style. Specimens may be seen in the eastern gallery of the great temple of the isle of Philoë, in an architrave fragment at Kaum Ombou, and in the temple of Hermoritis. Some of the finest remains of Egyptian temples are found in the ruins of the ancient Thebes, the city with a hundred gates. A characteristic of Egyptian architecture, is a peculiar narrowness of intercolumniation, being often not more than three feet and a half in width. In the temples and large edifices of Egypt, there appears to have been no use made of wood. Even the roofs, when used, were generally of immense masses of stone. Large stones, resting at each end, upon the walls of the halls, served for beams.—These were often supported in various parts by massive columns. One single stone, of enormous size, sometimes formed a complete roof. Either from ignorance or contempt, but most probably from the former, not a single specimen of the arch is found in the Egyptian works, their place being invariably supplied by epistylia, stone beams, or lintels. Dr. Pococke imagined that the ancient Egyptians were not ignorant of the construction of the arch; and Belzoni found specimens at Thebes, and at Gournon, under the rocks which separate that place from the valley Babel el Malook.—But these might be of later formation. A portico in the temple of Hermopolis is of the following dimensions:—height of portico, 60 feet; height of pillars, 36 feet; diameter of the pillars, 8 feet 10 inches; the architrave, as well as frieze, composed only of five blocks, each 22 feet long; one stone only of the cornice remains, measuring 34 feet.

The columns of the Egyptian buildings vary greatly in style, dimensions, and proportions. The diameter of the column is found to be generally from 7½ to 12 feet, varying according to their situation, even in the same building. The height is generally found to be about 4½ diameters. They sometimes represent the plain trunk of a tree, as in those of the little temple adjoining the temple at Luxor, from which the heavy tapered shaft of the Doric seems to have originated. Sometimes they represent bundles of reeds, or the whole plant of the papyrus, bound together at different distances, and ornamented at the base with palm leaves. The division between the reeds appears to have given the idea of the Grecian fluting, and the bindings to their torus and astragals. The central swell of the early Doric shaft may be traced in the columns of the southern temple at Karnac. Some columns represent the whole plant of the lotus, the date palm, or the papyrus, whose calyx flower, or tuft of leaves, bound together at the pinnacle, form the capital.—The capitals of the Egyptian columns represent nearly all the flowers or leaves peculiar to the country; the petals, capsules, pistils, seeds, and most minute parts, being often exhibited. The head of Isis, also, with its attributes, often forms the capital in the larger temples. The Ionic volute is distinctly traceable in those belonging to Latopolis, at Esneh, at Edfu, and at Kaum Ombou. Capitals are often seen resembling a vase, and at other times a bell reversed.

In the plates of *Egyptian Architecture*, fig. H is the capital to the columns of the temple of Typhon or Ausiris, the evil genius, or god of the Kamsin or destroying wind. Fig. G, the head of Isis, with all the attributes of that goddess, crowning the columns of the temple at Dendera. The rest, from *fig.* I to R, are various specimens of capitals, taken chiefly from the temples at Edfu, Esneh, &c.

The door-ways of the temples, which are generally the most ornamental parts, are invariably surmounted with a winged globe, a type of the deity. In some examples, as in one of the temples at Karnac, colossal figures are used as columns, in the manner of the Grecian caryatides. Statues of the gods, in a few constrained and remarkably stiff and formal attitudes, occupied various parts of the temple.

Some of the most magnificent specimens of the architecture of Egypt are exhibited in the sepulchral monuments. Of the pyramids, a complete account will be found under the article *Pyramid.* And of the vast sepulchral excavations, which were divided into a variety of chambers, branching out in different directions, forming an extensive subterranean labyrinth, richly adorned with colossal statues, paintings, and hieroglyphics, a succinct account has been already given under that of *Catacomb.*—The obelisks, quadrilateral acuminated beams, terminating in a pyramidal apex, were, like every thing else, covered with significant hieroglyphics. They were generally formed of a single block of red granite. See *Obelisk.* See also, *Capital, Abydus, Ægyptilia, Ælurus, Abacus, Adrian's Villa, Entablature, Labyrinth, &c.*

EKKYKLEMA, (Gr.) a machine used in the ancient theatres, to represent what was passing in the interior of a house, &c.; called also *Exostra.* See this word.

ELÆOTHESIUM, (Ελαιοθεσιον, Gr.) according to Vitruvius, the apartment in the ancient baths, situated by the side of the frigidarium, in which the bathers used to anoint their bodies when they left the bath. It was sometimes termed *unctuarium.*

ELBOWS *of a window*, the two panelled flanks, one under each shutter.

ELEPHANTA, an island in the harbour of Bombay, celebrated for the extraordinary excavations and architectural remains of the ancient Hindûs, which it contains. The following account is taken from the Memoir by Mr. Goldingham, in the fourth volume of the Asiatic Researches:—

Near the landing-place is an elephant of black stone, as large as life, from which the island probably took its name. The cave is about three-quarters of a mile from the beach, and is formed in a hill of stone along a beautiful valley, and its massy roof supported by rows of columns regularly disposed. Gigantic figures in relief, as well as the equally massy columns, have all been formed out of the solid rock. Several of the columns have been levelled, and the figures mutilated, by the Portuguese, who, prompted by their blind superstition, had been at the trouble of dragging cannon up the hill for its destruction.

The wall, at the upper end of the cave, is crowded with sculptures. A colossal bust represents a being with three heads; the middle face, represented in full, expresses a dignified composure; the head and neck are covered with ornaments. The face on the left is in profile, with a rich head-dress; in one hand is a flower, and in the other a fruit, resembling the pomegranate; on one of its wrists is a ring, like those at present worn by the Hindûs; the expression of the countenance is not unpleasant. The head on the right is different; the face is in profile, the forehead projects, the eyes stare; the place of hair is supplied by snakes, and a human skull is figured on the covering of the head; one hand grasps a monstrous *cobra de capella* (the hooded snake,) the other a smaller one. The height of this bust is about eighteen feet, and the breadth of the middle face about four. On each side of this niche is a gigantic figure, leaning on a dwarf. A niche of considerable size is formed on each side of the former. In the middle of that to the right stands a gigantic figure, apparently a female, but with only one breast. Of her four hands, the foremost to the right is leaning on the head of a bull, the other grasps a *cobra de capella*, and in the inner left hand is a circular shield.—On the right stands a male figure bearing a pronged instrument, resembling a trident; and on the left, a female holding a mace or sceptre. Near the principal is a beautiful youth on an elephant, above which a figure with four heads is supported by swans or geese; a male figure opposite, with four arms, is mounted on the shoulders of another, with a sceptre in its hand. Small figures at the top of the niche appear to be supported by clouds. In the niche to the left is a male figure, nearly seventeen feet high, with four arms, and a female about fifteen feet high, on his left. A figure with four heads, supported by birds, and one with four arms on the shoulders of another, are observed in the back ground. Several small figures are in attendance, one of which, in the attitude of addressing the principal, with the right knee bent to the ground, bears a crese, exactly resembling those at present used.

A small dark room, on each side of these groups, was held sacred in ancient times, perhaps from all but the unpolluted brahmin. To the left of the group last described, and nearer the side of the cave, a male is leading a female towards a majestic figure, seated in the corner of the niche; his head covered like our judges on the bench. The countenance and attitude of the female express modesty and timid reluctance; whilst a male behind is urging her forward. Several smaller figures compose this group. Opposite this niche, and fifty feet nearer the entrance, is another of equal dimensions, enclosing a gigantic half-length of a male with eight arms; round one of the left arms is a belt of human heads; a right hand grasps a sword uplifted, to sever a figure seemingly kneeling on a block, but much mutilated, held in the corresponding left hand; a *cobra de capella* rises under one arm: among the singular decorations of the head is a skull; above, several small figures are represented as in distress and pain. On the other side of the cave, near to one of the small rooms beforementioned, a male and female are represented sitting, with an attendant on each side, and a figure of a bull couching at the feet of the male; and in each corner of the niche stands a gigantic guard. In the niche opposite, from its mutilated condition, only a sitting male figure, and an attendant on either side, can be perceived. A niche filled with figures, greatly defaced, occupies each side of the door. On one side there appears to have been a male with eight arms, and in the back part a figure with four arms, supported by birds, and a figure with four heads. In the opposite niche, the principal is a large sitting figure, with a horse and rider in the back ground.

On the left side, half way up the cave, is an apartment about thirty feet square, enclosing the *Lingam*;

on each of the four sides is an entrance supported by a figure seventeen feet high. The part of the cave hitherto described is called the *great cave:* it is about one hundred and thirty-five feet square. On both sides are compartments, separated from the great cave by large fragments of rock and loose earth. That on the right, which is a spacious building, contains, among several other pieces of sculpture, a large figure, with a human body, and elephant's head: the Lingam is also enclosed here. The compartment on the other side contains likewise a figure with an elephant's head and human body, with other sculptures. A deep cavity in the rock here contains cool and excellent water.

Mr. Goldingham supposes this cave to have been a temple dedicated to *Siva*, the *destroyer*, or *changer*. The bust he considers as a personification of the three grand Hindû attributes of that being, for whom the ancient Hindûs entertained the most profound veneration. The middle head represents *Brahma*, or the creative attribute, that on the left, *Vishnu*, or the preserving, and that on the right, *Siva*, or the destructive attribute. The figure with one breast is a representation of *Siva*, exhibiting the active power of her lord; not only as *Bawani*, or courage, but as *Isani*, or the goddess of nature considered as male and female, and presiding over generation, and also as *Durga*. We here find the bull of *Iswara*, (one of *Siva's* names), and the figure bearing his trisule or trident. The beautiful figure on the elephant is conceived to be *Cama*, or the Hindû god of love; the figure with four heads, supported by birds, is *Brahma*, and that with four arms, on another's shoulders, is *Vishnu*. The two principal figures in the niche to the left appear to be *Siva*, and his goddess as *Parvata*: here also are *Brahma* and *Vishnu*, in the back ground. The terrific figure, with eight arms, is the third attribute, or the *destroyer in action*. The distant scene, where the smaller figures appear in distress and pain, is, perhaps, the infernal regions. The sitting male and female, with the bull, are *Siva* and his goddess. The figure with the human body, and elephant's head, is *Ganesa*, the Hindû god of wisdom, and first-born of Siva.

General Carnac, of Calcutta, who introduced Mr. Goldingham's paper, does not assent to the Elephanta cave being of Hindû construction. These immense excavations, cut out of the solid rock, appeared to him to be operations of too great labour to have been executed by the hands of so feeble and effeminate a race of beings as the aborigines of India are generally considered to have been; the few figures, he says, which still remain entire, represent persons totally distinct in exterior from the present Hindûs, and bearing much resemblance to the Abyssinians. He adds, that there is little or no reverence paid to them by the natives, and there is, he says, no tradition of their ever having been places of Hindû worship; but a writer, in the Archaiologia, (vol. vii. p. 286,) who visited these excavations in 1782, states, that he was accompanied by a learned brahmin, from Benares, who, though he had never been there before, recognized, at once, all the figures, and explained with fluency the history of each personage, and the meaning of all the various symbols with which they were accompanied.

ELEPHANTINA, an island of Egypt, on the Nile, covered with ruins of temples, fortifications, &c. There are no buildings of consequence, however, in any thing approaching a perfect state. Six magnificent columns of an ancient temple, covered with hieroglyphics, a granite statue of Osiris, much defaced, a small peripteral temple, 36 feet, by 20, with seven square columns on each side, which, except the usual winged globe and serpent over the door, and the sculptures and hierogliphics which cover the walls, has none of the characteristics of an Egyptian temple, and two elevated shafts, of the pyramidal propylon of a more magnificent temple, are the principal remains.

Elevation, (*elevatio*, Lat.) a geometrical projection drawn on a plain perpendicular to the horizon.

Eleusis, a town of Attica, formerly celebrated for its temple of Ceres and Proserpine, and for the *Eleusinian Mysteries* which were celebrated in it. There was also a temple of Diana Propylæa. Eleusis is now a miserable village, of about thirty mud houses. It was visited, in 1812, by a mission from the Dilettanti Society, of London, consisting of Sir William Gell, a member of the society, and well known by his works on the Troad, Ithaca, Argolis, and Pompeii, assisted by two architects, Messrs. J. B. Gandy, and F. Bedford. While at Athens, they employed themselves in excavations at Eleusis, whose temples had never yet been examined, from the depth of soil under which these ruins were buried. They succeeded in discovering the great mystic temple of Ceres, consisting of a cella, about a hundred and eighty feet square, with a portico of twelve magnificent Doric columns, of white marble, more than six feet in diameter. This temple was approached from Athens, by the *sacred way*, over an extensive pavement, supposed by the travellers to be the area of Triptolemus; on the right-hand of it was discovered a small, but beautiful Doric temple *in antis*, which appeared to correspond with that of Diana Propylæa. The Propylæum itself, was exactly like that of the Acropolis of Athens, described by Stuart. Within this was a second portal, of the Corinthian order, opening immediately into the peribolus of the great temple. A descriptive volume has been published by the society, entitled, "The unedited Antiquities of Athens, comprising the architectural remains of Eleusis, Rhamsius, Sunium, and Thoricus; by the Society of Dilettanti; imperial folio, 78 fine plates, by the best engravers, from the drawings of John Peter Gandy, and Francis Bedford."

Eleutherai, see *Acropolis*.

Elgin Marbles, see *Acropolis*.

El Hadda, see *Arabian Architecture*

Ellipsis, or **Ellipse**, (ελλειψις, Gr.) an oval figure, generated from the section of a cone, by a plane cutting both sides of the cone, but not parallel with the base. If a series of parallel straight lines, each limited at each extremity by the curve, can be all divided into two equal parts by a straight line, each half of each of the parallel lines is called an *ordinate;* the entire line, a *double ordinate*, and the dividing line, the *abcessa*. The point in which the abscessa meets the curve, is called the *vertex* of the ellipse. The whole of the straight line between the two vertices, is called a *diameter* of the ellipse. The middle of the diameter, is the *centre*. The double ordinate which passes through the centre, and the diameter, are called *conjugate diameters* to each other. Two diameters, perpendicular to each other, are called the axes, the greater, being the *axis major*, the less, the *axis minor*. To find the area of an ellipse, the two axes being given, we must multiply the one axis by the other, and the product by 7854. And to find the area of an elliptic arch, we must multiply the span by the height of the arch, and the product by 7854.

Ellipsoid, an elliptical spheroid, being a solid generated by the revolution of an ellipse about either axis.

Ellora, an ancient Hindû town, called also Elloor, and Verrool, said to have been built by, and to have taken its name from, Elloo rajah. It is in a fine valley, near Dowlatabad, and the surrounding mountains are celebrated for the very ancient and extraordinary excavated temples or pagodas, cut out of the rock by its former inhabitants. These wonderful caverns were visited by Thevenot, (Voyages, part. iii. c. 44.) Sir Charles Ware Malet, who visited them in 1794, published an account of them in the sixth volume of the Oriental Researches, accompanied by a plan. He did not doubt their being the works of a people, whose religion and mythology were purely Hindû, and he judges, that they were dedicated to *Mahdew*, or *Mohadeo*. He found several inscriptions in letters considerably differing from the present known characters of India, and was of opinion, that the most northerly caves of Ellora, occupied by the naked, sitting, and standing figures, are the works of the *Sewras* or *Juttees*, who, by the brahmins are esteemed schismatics, and whose sect, called *Srawuk*, is still numerous in Guzerat. A brahmin, who was an inhabitant of Roza, informed Sir Charles, on the authority of a book entitled *Sewa Lye Mahat*, or the grandeur of the mansion of *Sewa*, or *Mahdew*, that these elevated temples were formed by *Elloo rajah*, the son of *Peshpont*, of Ellichpore, when 3000 years of the *Dwarp Yoag* were unaccomplished, which, added to 4984 of the present *Kal Yoag*, make an age of 7984 years, to the year of Sir Charles Malet's visit. A Mahomedan, named *Meer ala Khan*, an inhabitant of Ahmednagure, told him that he had been informed, by a person of acknowledged erudition, that they were the work of rajah *Eel*, who was contemporary with Shah Momim Arif, who lived above 900 years ago. A collection of views of the Ellora excavations has been published by Daniell.

Beginning with the most northerly, the first cavern is called *Jugnath Sabba*, and fronts 15 E. The lower story is almost choked up. The upper story is ascended by a flight of steps in the right corner. A large figure, sitting cross-legged, opposite the front of the cave, was called by the brahmin who attended Sir Charles, *Jugnath*, and his two attendants, *Jay* and *Bidjee*, who, in the Hindû mythology, are the door-keepers of Vishnu. Two standing figures on each side of the recess, he called *Sud* and *Bud*. The whole room has the same figures as that in the recess, smaller, and all apparently naked. This cave consists of two oblong squares, the inner one formed by twelve pillars, of which the four at each end differ from those in the centre. The ceiling has been handsomely painted in circles, with figures of men, women, &c. but apparently the painting is much more modern than the rest, as much of the fine sculpture and fluting of the pillars are covered with it. The second excavation, called *Adnaut Subba*, is on the left of the first. Its entrance is unfinished; above it are figures of *Luchmee Narrain*, and two attendants, much mutilated. At the far end of the cave, is sitting the idol *Adnaut*. A small opening on the left, leads to another cave, smaller, and of much better workmanship, but so choked with earth, as to leave scarcely more above the ground than the capitals of pillars, which are handsomely finished in the style of the front ones of the first cave. The third, called *Indur Subba*, fronting the south, is a magnificent assemblage of excavations, entered by a handsome gateway cut from the rock, on which are two lions couchant. The doorway leads into an area, in which stands a pagoda, or temple, of a pyramidal form, containing a kind of square altar, with figures on each side like those on the last cave. The temple is elaborately finished with sculpture, and a mass of sculptured rocks serves as the gate. On the left, in the same area, is a very handsome obelisk, fluted, and ornamented with great taste; its capital adorned with a group of sitting figures. On the right side is an elephant without rider, or *hoda*, On the left of it is an excavation, with a figure like the preceding ones in the recess. The excavations on the right are imperfect. The area leads into the lower story of the *Subba*, which is unfinished, but contains a figure in the recess opposite the entrance like the former. A flight of steps on the right, lead to the upper story, fronting the top of which is a gigantic figure of *Indur*, with a tiara on his head, a *jinoee*, or brahmin string, over his left shoulder, sitting on an elephant couched; under a mango tree opposite him, is *Indranee*, his consort, on a lion. A recess at the end of this cave contains the same figure as the former. This room is divided into two squares by twelve pillars; an altar occupiesthe middle of the inner square.

The fourth cave, *Pursaram Subba*, is entered by a passage from the left hand side of the upper story of the last excavation, and also by a passage from the upper story of *Jugnath Subba*. It is smaller than any of the foregoing, and exactly like them in fabric and preservation.

Doomar Leyna, the fifth cave, fronting W. 15 S. is about a quarter of a mile from the last. The entrance is through a lane in the rocky mountain. On the left of this lane is a cave, almost choked up with earth. The lane opens into an area, at the end of which, opposite the entrance, is a small cave. The great excavation on the right of this area, has, at its entrance, two lions couchant. The entrance is by a kind of veranda, on the left of which is a gigantic sitting figure of *Durma rajah*, who has a club in his hand, and a jinoee over his shoulders. On the right is *Wisweyshevur Mahdew* in a dancing attitude, with a group of figures round him, among which is the bull *Nundee*. The cave widens considerably after passing the veranda, and continues to do so, particularly after passing the next section of pillars, till it reaches the centre or fourth section, on the left of which is the centre door of an elegant square temple; at the right entrance of this temple is a standing figure of *Mun*, with a tiara and jinoee, with *Bouannee* standing by him, and two small figures above. On the other side are various deities in a similar style. A small area at the end of this apartment descends a great depth by steps to a pool of water supplied by a cascade that falls during the rainy season from the whole height of the mountain. On entering the first section of pillars, the nuptials of *Goura Mahdew* and *Parwuttee*, with a number of figures above, occupy the right-hand side. *Rajah Dutz* and *Alia*, *Parwuttee's* father and mother, are on one side, and *Brimha*, in a sitting posture, performs the marriage ceremony, with *Vishnu* standing behind him. In front are the circles cut in the floor for performing the *Ludea Home*, or nuptial sacrifices. In a group on the left is *Mahdew* and *Parwuttee*, with the bull *Nundee*. Remains of paintings are distinguished on the ceiling of this cave. The number of pillars is forty-four.

The sixth cavern, called *Junwassa*, or the place of nuptials, with an aspect W.N.W. is much inferior to the preceding, and is entered from a veranda by the door. The cave has a veranda with windows, by which light is admitted to the inner cave, and in which there are figures of *Mahdew*, *Vishnu*, and *Brimha*, on the left of the door, *Bhutlel*, *Luchme*, and *Narraine*, on the right, and of the *Bharra Outar*, at the left extremity, in which the boar is represented as bearing *Pritwas*, or the world, on his tooth, and having *Seys* under his foot. A sleeping figure of *Koom Kurn*, on the right, is attended by a female.

The seventh, *Comar Warra*, with an aspect W.N.W. near the last, has its entrance much obstructed by fallen rock and accumulated earth. It is composed of four sections, divided by four pillars; the sections decrease gradually in length, the last being a recess, on each side of the door of which are coloured figures, one with a drawn sword, the other mutilated.

The eighth cavern, called *Gaana*, or the oil-shop, is a small group of little rooms a few yards from the last. It contains a figure of *Gunnes*, and the *Ling* of *Mahdew*. Very near it is another group of small rooms, with two *Lings* of *Mahdew*.

The ninth excavation, *Neelkunt Mahdew*, with an aspect W.S.W., is a few yards from the last. A small enclosure at the entrance contains the bull of *Nundee*, with two mutilated figures on each side. A recess opposite the doors contains the *Ling* of *Mahdew*, made of fine smooth stone. This cave is composed of sections formed by rows of pillars decreasing in lateral length to the recess.

The tenth cavern is *Ramiskwur*, aspect W.S.W. a few yards from the last. At its entrance is the bull *Nundee* couchant, and on the left a cistern of fine water. Four pillars and two pilasters, of considerable beauty and elaborate workmanship, support the front, and at the extremities on each side are female figures. In a large recess opposite the centre of the entrance is a temple containing the *Ling* of *Mahdew*. The rest of the cave forms a large hall, at each end of which are recesses, containing figures. The extreme wall of that to the right is occupied by the *Nou Chunda*. A group of skeleton figures on the right of this recess are said to represent a miser, his wife, son, and daughter, all praying in vain for food, while two thieves are carrying off his wealth. Opposite this group is another of *Kal Behroo*. As we entered the hall from the recess, on the right hand is *Mahdew* and *Parwuttee* playing at *Chousur*, with *Narraud* sitting between them stimulating a feud, which is below represented as having taken place. On the right side of the left recess at the end of the hall is the group of *Bonanee Mysaseer*, on the left that of *Swammy Kartick*, with his peacock and two mendaseers. In the centre of the recess, on the extreme wall, are the nuptials of *Jenuuck rajah*, *Gunnes*, *Brimha*, &c. officiating at the ceremonies. On entering the hall from the left recess, *Goura* and

Parwuttee are represented on the left in heaven, supplicated by Ronon. On each side of the door of the temple in the recess are two gigantic and two smaller figures, the former said to be *Apraon* and *Mewraon*, the latter *Keyroo*, *Bhut*, and *Vishnoo*. Many of the pillars in this cave are elaborately ornamented. A smaller cave near it contains the *Ling* of *Mahdew*, and a little farther is one of larger dimensions, but plain, and almost choked up. Several other such excavations lay about them. The eleventh cave, called *Keylas*, or Paradise, looking to the west, has a more splendid front than any of the others. A cistern of fine water is on the right of the entrance. On each side of the gateway a projection reaches to the first story, with much sculpture and handsome battlements. The gateway is spacious and fine, and has an apartment on each side. A balcony over the gateway seems intended for the *Nobut Khanneh*. The pillars on the inside of the upper story of the gateway bear a striking resemblance to the Grecian style. On the right side of the passage through the gateway below is *Bonannee Ushtbooza*, and on the left *Gunnes*. The gateway leads to a vast area cut through the solid rock, in which there is an immense pyramidal temple, "whose wonderful structure, variety, profusion, and minuteness of ornament, beggar all description."

This temple, which is itself cut out of the solid rock, is connected with the gateway by a bridge, also of solid rock. Beneath the bridge, at the end opposite the entrance, is *Bonannee*, sitting on a lotus, with two elephants with their trunks joined over her head. An elephant stands on each side of the passage under the bridge, but both have been mutilated. Ranges of apartments occupy each side behind the elephants, those on the left being much the finest, and richly decorated with figures. Two square obelisks stand behind the elephants, handsomely graduated to the commencement of the capital, which appeared to have been a single lion on each.

The twelfth cave, called *Dus Outar*, with a western aspect, at a small distance from *Keylus*, is entered by rough steps in the rock, the original entry being built up. The middle of the area is occupied by what has been a very handsome square apartment, which was formerly ascended by a handsome flight of steps, forming the portico, the roof of which, having been supported by two pillars, and one having given way, has fallen in. The front of the square has a stone lattice in the centre, with figures in the compartments on both sides. On the left are cells with fine water, and on the right a dry water cistern. The front of this area is much filled with earth, washed in by the rain from the surrounding hills. The entrance into the square apartment is from the main structure, which consists of two stories, both having a front of six pillars and two pilasters. The lower story is plain, and its pillars are all square and massy. The room above is of great dimensions, supported by eight rows of pillars in depth, all of which, except the front row, are square and plain. At the extremity of the centre aisle a recess contains the *Ling* of *Mahdew*, and in front of it is the bull *Nundee*, which has lost its head. The lateral walls, as well as that on each side of the recess, are adorned with well preserved mythological figures, amongst which the *Dus Outar* (or ten incarnations) is conspicuous. In the centre of each side of the lateral walls is an altar.

The thirteenth cave, called *Teen Tal*, (or three stories,) looking W.10S. is a few yards to the South of *Dus Outar* and is entered from a level surface through a good gate in a wall left as the rock was hewn. The front has a fine and simple appearance, being composed of eight square pillars and two pilasters in each story, all of them ornamented, except the centre ones of the ground story. The area, after entering it a few paces, widens, and in the left hand corner is a reservoir of clear water, and opposite it an inconsiderable raised excavation The lower story has six pillars in its length; at the extremity is a recess, with a gigantic image of *Seys*. As we proceed up the middle aisle, the excavation narrows at the fourth pillar, and continues so to the end, having a small room on each side, and in the next panel two very large sitting figures of *Sukur Achary* and *Adnaut*. The ascent from the ground floor is by a good staircase on the right; in ascending, a recess fronts you, which has a large sitting figure of *Covere*, with several others. Opposite the veranda of the second story, the figure of *Jum* is seated in a recess. A doorway at each end of the veranda leads to four rooms. The wall of the rock is continued from these doors to the third pillar on each side, and to the second in depth, to give space for two plain rooms on each side. In a recess at the extremity of the centre aisle is a very large sitting figure of *Luchmon*, with two colossal statues on each side of the door. The greatest depth, of this fine room has six pillars clear of wall, all of which are square and plain. A staircase leads into the room above by a door, on the left of which, in the landing place, is a small room, and opposite the entrance, at the end of the veranda, a colossal figure of *Sey Dew*; on the left, *Lukkool*, next to him *Bheem*, and then *Arjun* and *Dhurm rajah*, the five sons of Pundoo. Opposite them are *Ooda*, *Mado*, *Penda*, and *Sudan*. As we advance through the middle aisle, the room is lessened at the six pillars, to make room on each side of this great recess for fourteen sitting figures with curled hair. We next enter a kind of vestibule, richly decorated with figures. A door in the centre leads into a recess; in front of the door is a gigantic figure of *Ram*, sitting on a throne, and attended by the usual deities employed in his service. *Seta* is placed on the wall opposite him, on the left side of the door. All the pillars of this apartment are square and plain. Remains of painting are found on the ceiling.

The fourteenth cave, called *Bhurt Chutterghun*, with an aspect W. 10 S., is an excavation of two stories, entered by the wall of the veranda, the staircase being choked up. It takes its name from being dedicated to *Bhurt* and *Chutterghun*, two brothers of Ramchunder, whose figures, according to the brahmins, were the principal in the place.

The fifteenth cave is *Biskurmah*, or *Viswakurma ka Joompree*, (*Biskurma*, the Carpenter's Hovel.) Front W. 5 S. According to the legend of the brahmin, *Biskurma*, the carpenter of *Ramchunder*, (*Viswa*, or *Wisma Kurma*, creator or maker of the world, but allegorically, artificer of *Ram*) fabricated the whole of the wonderful works at Ellora in a night of six months, which was caused on purpose for him; but the cock crowing before they were finished, they remained imperfect, and he retired, having wounded his finger, to this his hovel; and they consider the figure in the front of the entrance of this beautiful excavation, as representing him holding his wounded finger; but Sir Charles, with more probability, thinks that it represents a figure in profound meditation, as many in similar postures occur. The portico of this cavern is light and striking. On the right is a cistern of water. Above the gateway is a balcony. The interior temple appears like an elegant chapel, with an arched roof, resembling in style a similar excavation at Kanara, on the island of Salsette, and another at Ekvera, near the top of Bhore Ghaut, first explored by Mr. Wales, the painter. From the ceiling are projected stone ribs, following the curvature of the arch to the capitals of the pillars on each side, through the whole length of the excavation. This singular formed cave, and the figure before mentioned, represents the Almighty meditating the creation of the world, under the arch or canopy of unlimited space.

The sixteenth cave, or rather group of caves, *Dehr Warra*, or the *Hallacore's Quarter*, so named by the natives, on account of their inferiority to the others. Front bearing from *Jugnath Subba*, from which they are about a mile distant, S. 25 E. The large cave is, however, a very fine one, and affords a beautiful prospect of the great tank, town, and valley of Ellora. Two parallel stripes of stone run along the floor the whole length of the cave, and seem designed for seats either to students, scribes, or the sellers of some commodity, a passage leading between them to the idol at the end. See *Adytum*.

Elm, a wood seldom used in building; liable to warp, or twist. For weather-boards on the sides of barns, and other out-buildings, it is found to resist the action of wind and weather, especially when coated with paint or other composition.

Embankments, are artificial mounds of earth, stone, or other materials, made to confine rivers, canals, and reservoirs of water within their prescribed limits; or to withstand the impetuous force of the sea; to form approaches across valleys or ravines to elevated stations, and for various other purposes. The most ancient embankments known, are said to have been those in the vicinity of the city of Babylon, for the support of causeways across the low grounds on each side the Euphrates, and leading to the celebrated bridge over that river. These are described by modern travellers as of incredible extent and magnitude. The Romans have left large and extensive works of this description on the banks of the Tiber and the Po; and in Britain the embankments in Romney Marsh, in Kent, are believed to have been of Roman origin, as also the first embankments on the Thames, which, from the nature and form of the surrounding country, must have been originally surrounded by extensive lakes; a supposition confirmed by the British name of the city of London, which was *Lyn-din*, (the city of the Lake) as also of the frequent recurrence of the term *wall*, in the names of adjacent places, as *Narrow-wall*, *Broad-wall*, *Rotherhithe-wall*, &c. In Kent and Essex, this term is universally applied to earthen embankments.. From its peculiar original formation, in consequence of the irregular recedence and encroachments of the ocean, the country of Holland is peculiarly subject to inundations; and, therefore, the inhabitants are obliged to raise extensive embankments, both against the sea, and upon the large rivers. The most remarkable of these are on the Issel, the Meuse, the Sparendam, and the Medenblik; and at the great Bay of Dollar. In England, nearly half a million of acres were regained from the overflowed lowlands of Lincolnshire, Cambridgeshire and Kent, previous to year 1560, by embankments constructed chiefly under the superintendence of Vermuyden, a Flemish engineer; and the incorporated company, established by Charles the Second, for upholding and continuing these works, is yet in existence.

In the formation of sea banks, by the continued motion of the waves, as it deposits long ridges of sand, to be slowly covered with the first rudiments of vegetation, and ultimately secured by the succession of different species of larger vegetable productions, whose branching roots embrace the consolidated mass, nature has given a lesson to art, which has been generally followed in these works. Wicker-work has been used in Holland; and bushwood, to retain the mud, and sand, and sea-weeds, which in time constituted alluvial soil. Sometimes it becomes an object of importance to regain a portion of land which has been a long time overflowed by an insular part of the sea; and this generally proves a work of great labour, especially where the bottom is sandy; turf is of service in these cases, particularly when it contains the roots of marsh grass. When the shore or bank is undermined by the waves, rows of piles are driven into the ground at a short distance from each other, and in a line with the bank, about 40 or 50 yards' distance from it, their tops being left to rise above high-water mark. This acts as a break-water, and preserves embankments. Large hampers of strong basket-work, filled with stones, are sometimes found a good preservative of these works, especially those against the sides of rivers, and rapid streams. The inner slope of an embankment should not exceed an angle of 45 degrees. The outer slope may vary from 15 to 45: the power of a bank to resist the weight of water, is inversely as to its acclivity; the power of water to destroy the bank being diminished nearly in the same proportion. In all embankments against rapid rivers, or the waves of the sea, the masonry introduced must be secured by the strongest Roman cement, which will set under water, and become as hard as stone.

A German agriculturist, in order to complete an embankment of very considerable dimensions in a very short time; raised two strong posts, leaving a sufficient space between them, with an inclined cord fastened to each, along which a bucket filled with earth was made to slide; the height sufficient to allow the bucket to clear the ground in its course. A muffle with a double hook was fastened to the cord, and a pulley, very deeply grooved, within the muffle, carried the buckets to the end of their course, where they were emptied, and returned by a second cord fixed to posts, with an inclination the reverse of the first, along which its own weight, with a slight impulse at starting carried it to its destination. This method is economical and expeditious; two men being sufficient to unhook and empty the buckets; it is also preferable to wheelbarrows on soft ground, where the wheels sink much.—*Repertory of Arts.*

Embattled, or indented with notches, in form of embrasures, and on the top of a wall, parapet, or other building. The heralds express this embattled line, or embrasure, by the term *crenelle:* the military architect sometimes calls them *cannonieres;* and *meurtrieres*, when only big enough for muskets; and when the parapet is so low that cannon may shoot without *embrasures*, they are said to shoot *en barb*.

EMBLEMATA, (Lat.) a kind of inlaid work used by the Romans to embellish panels, floors, &c. They were distinguished into *emblemata vermiculata*, *pavimenta tessulata*, *pavimenta musica*, &c.

EMBOSSING, (from *bosse*, Fr. a protuberance,) sculpture in relievo, the figures standing partly out from the plane. See *Acrostolium*.

EMBRASURE, (Fr.) the enlargement of the aperture of a door or window towards the inside of the wall; its use being to give greater play for the opening of the door or casement, and to admit more light. Also an aperture in the wall, through which cannon is pointed, the same as a battlement. See *Crenelle* and *Barbican*.

EMISSARIUM, (Lat.) a canal with floodgates, sluices, &c., used to regulate the water in the great lakes of ancient Italy. The two principal were those of the Lake Albano and of the Fucine Lake. The former was built about A.U.C. 355, during the siege of Veii, to carry off the overflowing waters of Lake Albano. That of the Fucine Lake was made by Claudius, and its remains are a fine example of the strength and durability of the ancient Roman architecture.

The emissarium of the Lake Albano, after a period of twenty-two centuries, now serves the same purpose for which it was first erected, that is, to discharge the waters of the lake, and carry them to the other side of the mountain into the fields which they fertilize. This canal was cut in the mountain of Albano, 300 feet above the village of Castel-Gandolfo, to the length of a mile and a half. Kircher and Piranési have carefully examined this emissarium. But the remains of another work of the same kind, and in the same place, by the emperor Claudius, have thrown more light on the mode employed in making this excavacation. In this emissarium numerous wells were sunk perpendicularly, and at intervals, from the surface of the mountain to the level of the canal, and galleries were pierced obliquely to meet them. Only one of these pits now remains visible, the traces of the others being obliterated. The entrance of the canal is adorned by an edifice, which contributes at the same time to the solidity of the work. This edifice, although ruined in some parts, still exists. It is built of large square stones, roughly joined, and forms an arched grotto, with a gate at the bottom, which gives passage to the water in the conduit of the emissarium. Next is a square building, arched in four compartments, and a kind of vestibule, the arch of which has fallen. The trees which have been permitted to grow about it, and the rustic character of the architecture, render it very picturesque, and worthy to be a model for similar buildings. This canal is built and arched with hewn stone in its whole length of 1260 toises. The emissarium of the Fucine lake, or, as it is now called, the *Lago Celano*, is a more considerable work than that of the Lake Albano. It consists of an opening twenty feet deep and ten broad, which traverses the whole width of a great mountain that lies between the Liris, into which the conduit was intended to discharge itself, and the lake. Thirty thousand men were employed, according to Pliny, ten years in completing it. The mountain is still pierced on every side with subterraneous galleries, and there are discovered a considerable series of vertical cavities, in the form of deep pits, to the bottom of which we may descend by passages cut in an inclined plane. A similar work appears to have been commenced at the lake of Avernus, and the passage, which is now shewn as leading to the pretended cave of the Sibyl, was probably but a trench, opened for a canal that was intended to receive the waters of the Avernus. See *Piranési Antichita Albane.* See also the article *Alba-Longa.*

EMPLECTON, (εμπληκτον, Gr.) a mode of constructing walls, in use among the Greeks, in which the front stones were wrought, and the interior left rough, and filled in with various-sized stones, &c. In this kind of works the Romans commonly omitted the *diatonoi*, or bond stones, which were constantly employed by the Greeks.

ENCARPUS, (ενκαρπος,Gr.) a festoon of fruit or flowers, which sometimes ornaments friezes or capitals.

ENDECAGON. See *Hendecagon.*

ENGAGED COLUMNS, are those attached to, or built in, walls or piers, a portion being concealed. Engaged columns are not agreeable with correct taste. From the design which Paoli has given of the little temple at Pæstum, we should be led to believe that there were engaged columns in the pronaos, at the extremities of the lateral walls of the cella; but the careful observations of M. Delagardette have proved that there were antæ with insulated columns before them on every side. Among the ruins of the temple of Apollo Didymæus, near Miletus, built in the time of Alexander the Great, was discovered a Corinthian capital, which made part of an engaged column, but it may be of an age posterior to the erection of the temple. In later times, the use of engaged columns became more frequent, and they were used to adorn the exterior façades of buildings, as may be seen in the Coloseum, the theatre of Marcellus, and the triumphal arch of Titus at Rome. The cella of a peculiar kind of temple, to which was given the name of *pseudoperipteros*, instead of being surrounded by insulated colonnades, had only one in front, whilst the other sides had only engaged columns. Such are the temple of Fortuna Virilis at Rome, and the Maison Carré at Nismes.

ENGLISH ARCHITECTURE, a name given by some to the Gothic style.

ENGLISH BOND. See *Bond* and *Bricklaying.*

ENSEMBLE, (Fr.) together, one with another. The *ensemble*, or *tout ensemble*, of a building, means the whole work or composition, considered together, and not in parts; and sometimes the relative proportion of the parts to the whole.

ENTABLATURE, (from *tabulatum*, Lat. *entablement*, Fr.) that part of a column which includes the *cornice*, *frieze*, and *architrave.* See those articles.—Amidst the remains of the ancient Hindoo architecture, no traces of the use of the entablature have been discovered; but it was not necessary, because the Indian temples were cut out of the rock, and consequently the columns had no roof to support. Whether the Persians employed an entablature is uncertain, but no vestiges can be found amongst the ruins of Persepolis The Egyptians are the only people of remote antiquity, whose buildings offer examples of its use. In the oldest Egyptian temples the entablature was very simple, being merely a single large stone, which was supported by the columns in the whole length of the building.

Entail, in Gothic architecture, delicate carving.

Entasis, (εντασις, Gr.) the slight curvature of the shafts of the ancient Grecian columns, particularly the Doric, which is scarcely perceptible, and beautifully graceful. Vitruvius having obscurely hinted at it, several of the modern Italian artists, intending to conform to his precept, carried it to an absurd excess, making the middle of the shaft thicker than the foot. The following method of obtaining the true *entasis* is given by Sir William Chambers, who has taken it from Blondel, a French architect.

"To give an actual idea of the operation, it will be necessary first to describe Vignola's method of diminution, on which it is grounded. 'As to the second method,' says Vignola, 'it is a discovery of my own; and though it be less known than the former, it will be readily comprehended by the figure, (*Plate* A 4.) Having therefore determined the measures of your column, (that is to say, the height of the shaft, and its inferior and superior diameters,) draw a line indefinitely from C through D, perpendicular to the axis of the column —this done, set off the distance, CD, which is the inferior semi-diameter, from A, the extreme point of the superior semidiameter, to B, a point in the axis. Then, from A, through B, draw the line ABE, which will cut the indefinite line CD in E; and from this point of intersection, E, draw through the axis of the column any number of rays, as E, *b*, *a*, on each of which, from the axis towards the circumference, setting off the interval CD, you may find any number of points, *a*, *a*, *a*, through which, if a curve be drawn, it will describe the swelling and diminution of the column.'

"Though this method be sufficiently accurate for practice, especially if a considerable number of points be found, yet, strictly speaking, it is defective; as the curve must either be drawn by hand, or by applying a flexible rule to all the points, both which are liable to variations. Blondel, therefore, to obviate this objection, (after having proved the curve passing from A to C, through the points *a*, *a*, to be of the same nature with the first conchoid of the ancients,) employed the instrument of Nicomedes to describe it, the construction of which is as follows:—

"Having determined, as before, the length of the shaft with the inferior and superior diameters of this column, and having likewise found the length of the line CDE; take thin rulers, either of wood or metal, as FG, ID, AH; of which let FG and ID be fastened together at right angles in G. Cut a dovetail groove in the middle of FG, from top to bottom; and at the point E, on the ruler ID, (whose distance from the middle of the groove in FG is the same as that of the point of intersection from the axis of the column,) fix a pin; then, on the ruler AH, set off the distance AB equal to CD, the inferior semidiameter of the column, and at the point B is a button, whose head must be exactly fitted to the groove made in FG, in which it is to slide, and at the other extremity of the ruler AH, cut a slit or channel from H to K, whose length must be less than the difference of length between EB and ED, and whose breadth must be sufficient to admit the pin fixed at E, which must pass through the slit, that the ruler may slide down.

"The instrument being thus

completed, if the middle of the groove in the ruler FG, be placed exactly over the axis of the column, it is evident that the ruler AH, in moving along the groove, will, with its extremity A, describe the curve A *a* *a* C, which curve is the same as that produced by Vignola's method of diminution, supposing it done with the utmost accuracy, for the interval A, B, *a*, *b*, is always the same; and the point E is the origin of an infinity of lines, of which the parts BA, *ba*, *ba*, extending from the axis to the circumference, are equal to each other, and to DC. And if the rulers be of an indefinite size, and the pins at E and B be made to run along their respective rulers, so that the interval AB and DE, may be augmented or diminished at pleasure; it is likewise evident, that the same instrument may be thus applied to columns of any size.

Envelope, (Fr.) in fortification, a work of earth, sometimes in form of a simple parapet, and at others like a small rampart with a parapet, raised sometimes on the ditch, and sometimes beyond it, for the purpose of covering weak places with single lines.

Ephebeium, (εφηβειον, Gr.) a building among the ancients, where youths or striplings wrestled and exercised.

Ephesus, a celebrated city of Ionia, once the metropolis of Asia Minor. It was celebrated principally for its temple of Diana, but that, as well as the beautiful Ionic temples of Apollo and Bacchus, and all the grandeur of the ancient city, have long since disappeared. See *Arch.*

Epicranitis, (επικρανιτις, Gr.) a name given by the Greeks to the tiles which formed the cyma or top bed of the cornice of the pediments of their temples. The word occurs in the celebrated inscription brought to England by Dr. Chandler. The angular stone which formed the vertex of the pediment, was termed the *angular epicranitis.*

Epicycloid, (επικυκλοειδης, Gr.) a curve generated by the revolution of the periphery of a circle along the convex or concave part of another circle.

Episcenium, or **Episcenos**, (επισκηνιον, Gr.) The upper part of the scene in ancient theatres, which had sometimes an attic or some other similar finish. See Vitruvius, lib. vii. c. 5, lib. v. c. 8.

Epistyle, (επιστυλιον, Gr.) a Grecian term, synonymous with *architrave*, being that member or division of the entablature, which lies immediately upon the abacus of the capital. The word occurs in Vitruvius, and in the Athenian inscription of Dr. Chandler.

Equiangular, having equal angles.

Equidistant, at equal distances.

Equilateral, having equal sides.

Eras, or *dates* of *Buildings*, see *Architecture.*

Erectheium, see *Acropolis*, and *Athenian Architecture.*

Ergastulum, (Lat.) the name given by the Romans to a prison, or house of correction, where slaves, by the private authority of their masters, were confined for their offences, and kept to hard labour. The Greeks called similar buildings Σωφρονιστηρια, Sophronisteria.

Escurial, a village in Spain, seven leagues from Madrid, celebrated for the magnificent palace of the Escurial, or St. Lorenzo, begun by Philip II. in 1557, in commemoration of the battle of St. Quintin. The arrangement of the whole building is in the form of a gridiron, by which St. Lorenzo suffered martyrdom. It has the appearance of a long parallelogram with four points. The north or principal point is 637 feet broad, and 51 high to the cornice. Each angle is flanked by a tower, 180 feet high. Of its three entrances, and two hundred windows, the lower part of the central gate is adorned with eight Doric columns, and the upper part with four of the Ionic order. The other fronts are of equal dimensions. That on the west has few windows. This vast edifice forms a monastery, as well as a palace. The old church is 129 feet long, and 33 broad. The refectory is 103 feet long, and 33 broad. The ground cloister is a square formed by a double row of piazzas one above the other, 93 feet long on each of the four sides, and 17 broad, the walls covered with fine paintings. The double cloister, built of granite, is 52 feet high, has four grand fronts, opening on a spacious court of 88 arches, supported by 96 columns, Doric below, and Ionic above. A small octagonal temple, terminating in a dome, occupies the centre, built without of granite, and within of fine jasper marble, its eight sides adorned alternately with projecting columns, or with statues. The library is adorned with fluted Doric columns, and the roof and frieze are covered with allegorical paintings. The royal apartments are adorned with very fine paintings. The Campana communicates with the main building by a double gallery, one above the other, eighty-six feet long, supported by Ionic columns. We descend into the church by a fine staircase, 136 feet broad, and 34 long, leading to a piazza, which forms the foreground of the church, and opens to five arcades, resting on pilasters, and Doric semicolumns. Above is raised a second body. This front is flanked by two towers, used as belfries. The inside of the church is built in the Doric style, in the form of a Greek cross, with a lofty dome in the centre, supported by eight symmetrical towers. The body of the church is 313 feet long, and 194 broad, and contains forty-eight altars. The interior of the choir is exquisitely finished, the walls and ceiling being covered with the fine paintings of Cambiaso. The chancel, which is raised by twelve steps, contains two mausoleums, containing statues of gilt bronze. The principal altar consists of four bodies of architecture; in the first of which are six Doric columns, in the second six fluted Ionic columns, in the third four fluted Corinthian columns, and in the fourth two Composite ones. Fifteen beautiful statues, and several paintings, are attached. A Corinthian circular table, fourteen feet seven inches high, and six feet seven inches in diameter, adorned with gilt bronze statues of the twelve apostles, and with eight columns of red jasper marble, which can scarcely be distinguished from agates, stands in the centre. It is terminated by a cupola of jasper marble, containing a statue of Christ, and adorned with a topaz as large as the hand, encased in a rose of gold. Another square tabernacle, nineteen inches high, and still more gorgeous, is contained within this. Each side is decorated with four columns, and four pilasters, their bases and capitals of gold enamel, and the cornice of silver. It is crowned with pyramidal spires, on pedestals of vermilion stone, embossed with gold. The two sides are formed by two doors of rock crystal, studded with gold, and the whole is surrounded by a cupola, with an emerald, attached to a rose of gold on the top, and on the inside a topaz enclosed in gold enamel. The sacristy is included in one beautiful nave, 93 feet long, and 80 broad. The treasury contains many articles of great value. The Pantheon, or place of interment for the royal family, is below the church, and is, perhaps, the most splendid part of the Escurial. The first descent is by 59 steps. The walls and arches are encrusted with fine marble. After a second descent, we discover a beautiful front, supported by ten marble Doric columns, the ornaments of gilt bronze. Another descent leads to the place of interment of the royal family. That of the kings and queens is an octagon, 31 feet in diameter, and 33 high, encrusted with beautiful marble of different colours, and adorned with statues of gilt bronze, Corinthian pilasters, &c. with four urns or tombs in each corner. The gardens, in the east and south of the palace, are disposed in the form of an amphitheatre, and are laid out in terraces, and surrounded by walls. Beautiful roads, often ornamented with elegant architectural objects, lead to the village from almost every side. The internal decorations of the Escurial were considerably injured by the French, during their occupation of Spain.

Estrade, (Fr.) an even or level space, a public road.

Etruscans, the people of Etruria, a country of Italy, now called Tuscany. The Etruscans were originally a colony from Greece, and preceded the other nations in Italy in cultivating the arts, having practised them even before the reputed time of Cadmus. Their arts were derived from Greece, by the migration of the Pelasgi, whose letters and dialect they used. Nola and Capua were founded about 801 years before the vulgar era. The earlier sculpture of the Romans is reported to have been executed by Etruscan artists. Under Tarquinius Priscus they practised the art of modelling, or plastic. Statues of Jupiter and Hercules are mentioned as having been formed by them of terra-cotta, and painted red. This is alluded to by Propertius, lib. iv. 1. The Etruscan style, according to Strabo, resembled the Egyptian, or rather the early Grecian. Quintilian censures it as *dry*, and Cicero as *hard*. See the Works of *Passeri*, *Gori*, and *Buonarotti*.

The Etruscans were as much distinguished in architecture, as in the other arts. Etruscan architects were employed by the Romans in the construction of the Capitol, the temple of Jupiter, and other edifices. The walls of the Etruscan cities are generally very high, and built of massy stones. Remains are still left of those of Volaterra, Cortona, Fæsula, &c. The gates were very simple, and built of stones of an oblong-square shape. The *Gate of Hercules*, at Volaterra, has a fine arch, composed of nineteen large stones. The first temples of the Etruscans were very small, and could contain only a statue, with sometimes an altar. Vitruvius has left us a description of some ancient Etruscan temples, which remained at Rome in his time. Their form was an oblong square, and the length was occupied by three chapels, of which that in the middle was the largest. In the temple of Jupiter in the Capitol, the middle chapel was dedicated to Jupiter, and those at each end to Juno and Minerva. The two façades were adorned with a pediment; the height of which was one-third of its breadth, and on its summit were ornaments of bronze or terra-cotta. The gates were often ornamented with pictures. Of the numerous fine and spacious theatres of the Etruscans there are now scarcely any remains: those of the theatre of Adria, which was of a peculiar form, are not considered to be the work of that people.

The Romans took the design of their circuses entirely from the Etruscans. At Volaterra are still seen the ruins of a public reservoir, built underground, 24 Roman feet high, 56 long, and 39 broad. Many Etruscan tombs, chiefly subterranean, have been opened, and descriptions of them published. The interior of the tomb near Crotona, is of the form of a cross, and in the wall are many niches, destined perhaps for the reception of urns. It is formed of twenty-seven stones of a large size, and joined with great exactness. Many others are cut in a sandy rock, as those near Clusium, Corneto, (the ancient Tarquinium,) Volaterra, and Talaris. The roofs of these latter kind are not vaulted, but flat, and the interior is painted and adorned with figures. Such was the labyrinth of king Porsenna, near Clusinim. (See *Labyrinth.*) The Etruscans built with brick, and with hewn stone. In the earliest times they gave their stones an irregular polygonal shape, and disposed them so as to touch on all their sides. A wall of this kind is found at Cora, near Velletri; an oblong square shape was afterwards adopted. The Etruscan architecture is distinguished by the invention of the *atria*, or courts, to private houses, of vaults, and of a peculiar order of column denominated *Tuscan*. The first owe their name, according to the common opinion, to the Etruscan colony of Adria or Atria. See *Atrium*. The use of vaults appears to have been very ancient amongst the Etruscans, and that of the subterranean reservoir at Volaterra proves their skill in the construction. On the columns of the Etruscans, see the article *Tuscan Order*.

Etruscan Buildings. See *Arch.*

Etruscan Pyramids. See *Choluta.*

Evolute, (Lat.) a curve first proposed by Mr. Huygens. It is any curve supposed to be evolved by having a thread wrapped close upon it, fastened at one end, and beginning to evolve or unwind the thread from the other end, keeping the part evolved tight stretched: this end of the thread will describe another curve called the *involute.*

Evolvent, (Lat.) a term used in the higher geometry, by some, for the involute, or curve, resulting from the evolution of a curve, in contradistinction to the evolute, or curve, supposed to be opened and evolved.

Euripus, (*ευριπος*, Gr.) the trench in the circus, which separated the seats from the arena.

Eurythmy, (*ευριθμια*, Gr.) "that agreeable harmony between the breadth, length, and height of all the rooms of the fabric, which suddenly, where it is, taketh every beholder, by the secret power of proportion." (Sir Henry Wotton.) The six essentials of architecture are, according to Vitruvius, (lib. i. c. 2.) *ordinatio, dispositio, eurythmia, symmetria, decor, distributio.*

Eustyle, (from *ευ*, beautiful, and *στυλος*, column, Gr.) an intercolumniation of two diameters and a quarter, which is one of the most beautiful arrangements that can be given to a row of columns. See *Intercolumniation.*

Ewenny Priory, in Glamorganshire, South Wales, was a religious institution, appended to Ogmore Castle, built by Morris de Londres, or his descendant John, in 1141, and still exhibiting one of the most perfect specimens of early Norman, or Saxon architecture known. The strong embattled walls and towers which appear among the ruins, indicate that it was not less a place of security than of religious rites. The hall of the house is a gloomy apartment, and contains several racks, which seem to have been the depositories of arms. The church is very massive, of a cruciform shape, and its unornamented heavy arches rest on short bulky columns of rude workmanship. The columns, plain capitals, and circular arches, denote it of the earliest Norman work. The broken pavement, formed of glazed earthen tiles, marked with devices, still to be seen in some places, is ancient and curious. "The simple groined roof of the choir," says Sir Richard Hoare, (Giraldus, 149,) "and the neglected tombstone of its founder, bearing this inscription, in old characters, claim particular attention. ICI GIST MORICE DE LUNDRES LE FVNDVR DEU LI RENDE SUN LABUR. AM." "The satisfaction with which I view this building," he continues, "as having remained untouched, unaltered, since the days of Giraldus, was considerably damped on beholding its present ruinous and dilapidated condition: in many places uncovered, and exposed to the rude elements, its windows unglazed, the curious stone-groined roof of its choir cracked, its tombstones, and, among them, that of its parent and founder, carelessly thrown about in the wildest confusion; in short, this old and once respected sanctuary, after an existence of nearly 700 years, is now approaching most rapidly its dissolution."

Exchange, an edifice where merchants, brokers, &c. negotiate their affairs. See *Burse*.

Exedra, (ἐξεδρα, Gr.) a small room set apart for conversation in the gymnasia, baths, &c. See *Chapel*.

Exostra, (ἐξοστρα, Gr.) the ancient stage never represented the interior of a building; when therefore the action required what was going on in the inside of a house or palace, to be exhibited to the spectators, it was done by means of a machine of timber, called an *exostra* or *ekkykloma*.

Extrados, the outside of an arch of a bridge, vault, &c.

Eye, the middle of the Ionic volute, from which the different centres for drawing it are found. Sometimes this term is applied to a small window in the centre of a pediment. See *Spiral*.

Eye-Brow, the same as fillet.

F.

Fabric, (Lat.) a term generally applied to a large building, as a church, a palace, or a college.

Façade, or **Face**, (Fr.) the whole exterior side of a building, that can be seen at one view. A good façade contributes greatly to give an interesting appearance, and to exhibit at once the character of the edifice; it ought therefore to be agreeable to the kind of building to which it belongs. A temple ought to have a different façade from an arsenal, and the façade of an arsenal should not resemble that of a palace. Every part should bear a proportionate form and dimensions: the windows should not be too numerous or too few; the columns should be neither too near each other, nor too distant; all the lines should be either exactly perpendicular or horizontal; the axes of all the columns which rise above each other on different stories should be on the same line. When a façade is of a considerable elevation, it should be divided into several parts, of which one, as the principal, should occupy the middle, and ought to be distinguished by superior grandeur and beauty. The ornaments of the façade should be striking and conspicuous, but no member should be so distinguished as to attract our attention exclusively.

Face Mould, the name given by workmen to the pattern for marking the plank or board out of which ornamental hand railings for stairs, or other works, are to be cut.

Face of a Stone, is that part which is made even, or smooth, to form the face, or outward part, of a building; stones are faced in the opposite direction of their spliting grain.

Facettes, are flat projections between the flutings of columns.

Facings, are the wooden coverings of the sides of windows and door-places in the insides of rooms, intended to give them a smooth and finished appearance.

Factabling, or *Coping*.

False Attic, an architectural finish, bearing some resemblance to the Attic order, but without pilasters, casements, or balustrade, used to crown a building, and to bear a bas relief or inscription, as at the gates of St. Denys and St. Martin, at Paris.

False Roof, is the space between the ceiling of the highest room or story of a house, and the roof.

Fanal, (Fr.) a lighthouse.

Fane, *Phane*, or *Vane*, a plate of metal usually cut into some fantastic form, and turning on a pivot, to point out the course of the wind.

Fanum, (Lat.) originally a plot of earth, consecrated to some divinity, but afterwards applied to the temple that was erected on the spot. It is often used indifferently for *ædes* or *templums*.

Fascia, (Lat.) a *Band*; a flat member in the entablatures of columns, or on other parts of buildings; sometimes it is written *Facia*. The architraves, in some of the orders, are composed of three bands, or fascia; the Tuscan and the Doric ought to have only one. Ornamental projections from the walls of brick buildings, over any of the windows, except the uppermost, are called *Fascia*. See *Band*.

Fastigium, the Latin name for the Greek Ætos. See *Ætos* and *Pediment*.

Fathom, (*fædm*, *Sax.*) a measure of six feet, the space over which a man may extend both his arms; used chiefly in measuring quarries, wells, reservoirs, and the depth of water.

Fauces, (Lat.) This term, used by Vitruvius, meant, probably, the entrance from the vestibule into the atrium, corresponding to the thyroreum of the Greek house, (see *House*,) which Vitruvius calls a passage of inconsiderable width. The word is used by Virgil in this figurative sense—

> Angustæque premunt fauces aditusque maligni.

Fauxburg, (Fr.) that part of a city which is without the gates and the fortifications.

Feather-edged Boards, are narrow boards made thin on one edge. They are used to form the facings of wooden walls, cottages, or out-houses, with the thick edge uppermost, and the thin edges projecting over the courses as they descend. They are also used in roofs, and placed vertically in fence walls.

Feather-edged Coping, see *Coping*.

Feeding House. A building or shed, for the feeding of cattle in a dry and warm situation, with a free circulation of air, and every necessary convenience for the reception of food and water.

Felt-grain. The mode of splitting or sawing timber in a line passing across the centre or heart of the tree; it is opposed to the mode of cutting, which following, as near as may be the course of the annular rings, is called *quarter grain.*

Femur; the plane space between the cavities of a triglyph: the word signifies a thigh. The Greek word *μηρος* has the same signification.

Fence of a joiner's plane, is that part which regulates in some, in others fixes, its position.

Festoon; an ornamental carving resembling a wreath attached at both ends, and falling in the middle.

Fillet. See *Annulet* and *Band.*

Filling-in-pieces, are short pieces of timber affixed to hips of roofs, groins, and other frame work.

Finial, (*finio*, Lat.) In the Gothic style of architecture, the figure of a lily, trefoil, endive, acorn, or other flower, foliage, or fruit, made to terminate canopies, pinnacles, high-pointed pediments, and other parts of buildings. See *Crocket.*

Fir; see *Deal.*

Fir-in-Bond, is a name given to lintels, bond-timbers, wall-plates, and all timbers built in walls. See *Bond.*

Fire-proof Houses. Vaulted or arched buildings may be constructed entirely of stone or brick, and consequently will be incombustible; but the necessary thickness of the walls darkens the rooms; and this mode of building is also too expensive for dwelling-houses. Various methods have been adopted to attain the intended purpose, and to obviate difficulties; cast iron instead of timber joists have been used, and plates of iron for floors and roofs.

In the "Repertory of Arts," vol. iii. third series, 1826, there is a valuable communication by the Rev. J. Boswell. In this essay, the author recommends the methods adopted in France, especially at Lyons, where it has proved exceedingly efficacious. This is chiefly dependent on the mode of laying the floors generally practised throughout France. As soon as the beams and rafters are laid, coarse rough boards are nailed upon them, and the whole is covered with a coat of plaster at least eight inches thick, over which again they lay tiles, mostly of an hexagonal form, about six inches across. Square tiles are only used for kitchens and passages; instead of which, thin flag-stones are sometimes used; even where the *parquet* floors are used, the plaster is laid under it, so that if one of the thin walnut panels of the parquet should be burned, it can neither spread, nor penetrate to the joists, for want of a communication of air from below. In the better houses, the staircases are made of frame-work of wood intermixed with bricks and plaster, and covered with tiles, and frequently of stone, and in Lyons stone stairs are almost universally used; and much ingenuity is displayed in their construction, with a beautiful simplicity of design, and the most efficient stability. "After experiencing," says the author, "the great security against fire, which houses built in this manner afford, and returning to our own deal floors and wooden staircases, and partitions of wainscot, or of lath and plaster, our houses seem like so many funeral piles of the ancients, only waiting for the application of the torch, or the casual fall of a candle, to burst into a flame, and consume the inhabitants."

In the "Philosophical Transactions" for 1778, p. 884, an experiment made by Lord Charles Mahon is described, of surrounding the joists of a plaster floor with a strong fire, the result of which was a perfect confirmation of the belief that this mode of securing buildings from fire will prove effectual.

In many instances the French builders fill up the intervals of the joists entirely with plaster, and dispense with boards altogether; the nature of their plaster enables them to do this, being made from gypsum, which is the common material of the country. It swells so much in setting, as to occasion a strong lateral adhesion to the sides of the joists, which, with the addition of the battons nailed below, very sufficiently supports the flooring tiles; besides, their dry plaster in a mass, as they prepare it, is nearly as firm and solid as our Bath stone, and will sustain very heavy weights before it will break. Even if from custom and prejudice the people of this country should disapprove of the appearance of tiled floors, yet these would not appear when covered with a carpet. But indeed the French, in their tiles, frequently produce so exact and beautiful an imitation of squares, or narrow panels, or inlaid work, composed of short narrow pieces of walnut wood, as to be with difficulty distinguished from floors of real parquet. It would indeed be not a matter of much difficulty to give the form and appearance of deal boards to those plastered or tiled floors; not even forgetting the heads of nails, if required. It is also believed, that floors of this construction would prove cheaper, and the cold air in winter would not find its way through chinks and crevices, as in boarded floors of inferior workmanship; they are found not only to resist the passage of cold air to the feet, but also intercept the conveyance of sound from one room to another.

If objections were made to stone stairs, a very excellent kind of stairs are made of plates of cast iron, supported by wrought iron traverses; a neat specimen of which has existed for many years in front of the late Duke of Queensberry's house in Piccadilly. Pointed stairs of this kind have an elegant appearance. Excellent stairs might be made at a less expense by Cumberland slates, or flag-stones, supported by wrought-iron traverses. The Cumberland slate, of one inch in thickness, will support as much weight as a Portland stone of five inches. In securing buildings against fire, the floor is of the first importance, since the fire almost invariably commences there; and next to these, the stairs; after which the partitions between rooms demand our attention; these should never be entirely of wood, especially in rooms where servants sleep; a four-inch wall, commonly called a partition of *brick noggin*, is always to be preferred for security.

The means already pointed out, if adopted, would diminish the danger from fire, in at least ninety-nine instances in a hundred, which arise from accidents, and render it extremely difficult for infernal incendiaries to put their diabolical designs in practice.

Considerable attention has been lately bestowed on this subject, and provision against the accident of fire has been made in buildings in every part of London, particularly in the new buildings in the Strand. In these erections, instead of wooden bressummers extending across the fronts, strong cast-iron ones are introduced, with supporters of the same material. This iron bressummer is covered with Yorkshire paving stone two inches thick, so that it will be impossible for fire to destroy the front, or dry-rot to sap the foundation. On a subject of such general interest, patent, and other inventions, are much too numerous to be particularized.

Fistuca, a pile-driving instrument, with two handles, raised by pulleys, and guided, in its descent, to fall on the head of a pile.

Flags, are flat stones, from one and a half to three inches in thickness, for floors.

Flank, (*flanc*, Fr.) the least side of a pavilion, by which it is joined to the main building. In fortification, it is that part of a bastion which reaches from the curtain to the face, and defends the opposite face, the flank, and the bastion.

Flat Roof. See *Carpentry*.

Flatting, in inside house-painting, is the mode of finishing without leaving a gloss on the surface: it is generally sufficient for this purpose to use a greater proportion of oil of turpentine, and the linseed oil unboiled.

Flemish Bond. See *Bricklaying*.

Flemish Bricks are used in paving; seventy-two will pave a square yard; they are of a yellowish colour, and harder than common bricks.

Flight of Steps *in a staircase*, is the series from one landing place to another.

Flitches. See *Carpentry*.

Floating, is the spreading of stucco, or plastering, on the surface of walls. Called also rendering, and setting.

Floating Bridges are composed of boats joined together by planks, with rails on each side; one end of this platform is sometimes fastened to an anchor in the middle of a river, and made to pass alternately from one side to the other.

Flood-gate, a gate made to resist or admit the current of water, in canals; and on rivers to retain the stream for the use of mills, docks, and reservoirs

Floor, (Sax.) the bottom of a room. Floors are commonly made of wood, which ought to be well seasoned, to prevent its springing: the timber and the boards for this purpose must therefore be rough planed, and put out to dry twelve months previous to their being used. For ground-floors, flag-stones or bricks are frequently used, or a composition of burnt clay and sharp sand, mixed up with bullock's blood, which being well beaten together, and spread out with a smooth surface, makes a beautiful and firm floor. But plaster-of-Paris, with other ingredients, finely sifted, makes floors nearly equal in appearance to marble; and marble is frequently used for the floors of halls and splendid apartments. See *Carpentry* and *Stucco*.

A lever-cramp, for laying floors, invented by Mr. Andrew Smith, of Pimlico, is described in the Register of Arts, the third series, vol. ii. 1828; the model of this invention may also be seen in the National Repository, near Chairing Cross. By the usual mode of uniting the edges of the boards together, so as to make the joints very tight, a considerable degree of labour and difficulty is generally experienced; and after all, the work is frequently very imperfect with respect to the complete closing of the joints.

Mr. Smith's machine completely obviates these inconveniences in the speediest, most effectual, and easiest manner possible. By this very simple and convenient apparatus, a single workman may, unassisted, lay down a large floor; when the lever is pulled down, the cramp holds the board immoveably whilst it is nailed down. It is unnecessary to attempt a minute description of this apparatus; the practical builder will know how to appreciate the value of this invention, which is so admirably calculated to give facility in perfecting his work.

Floors of wood, resting on arches formed of conical pots of earthenware, have been a considerable time in use in cotton mills; but the combination of iron framing with arches of pottery, in the manner employed by M. Louis, the French architect, is not so generally known. Floors constructed by this gentleman, in the Palais Royal at Paris, are minutely described in Tilloch's Mechanic's Oracle. Frames of wrought iron serve as supporters, and to form girders, with tie-bars and abutments. The bearing is on the edge of the arched bars, which are bound together by stirrups and cross bars. The compartments in this iron frame-work are filled up with earthen pots of a conical shape, so arranged, as to form a series of arches; and these are bedded in plaster. The construction of the frame-work in these floors secures from lateral pressure by the cross-ties and the arches between them, and their strength is therefore only to be considered as it regards vertical pressure; and they may be made so that they will be equally strong at every part of the length.

Vaulting, constructed of hollow conical pots of earthenware, was first known in France in 1787: these pots are either square, hexagonal, or circular, and are joined with plaster-of-paris. This practice has also been introduced into England: the pots are manufactured in Derbyshire, as mentioned in Farey's Derbyshire Reports. It is obvious, that the circular or hexagonal pots have the best form; and when joined with Roman cement, floors of this kind are very strong, secure against fire, and excellently adapted for workshops and manufactories.

Florid Style. See *Gothic.*

Flue, the tube from a fire-place. See *Chimney.*

Flush, a term used by workmen, to denote the continuity of two or more parts of joiner's work to the same surface.

Flush and Bead. See *Bead* and *Flush.*

Flutings, (*striges*, *rugæ*, Lat. *cannelures*, Fr.) longitudinal cavities cut on the shaft of a column or pilaster, &c. Fluting appears never to have been used in Egyptian columns, although in various parts of the Egyptian edifices has been traced something of the same principle. The Persian architects were excessively fond of it, and on some of the columns at Persepolis may be counted forty flutes. The Greeks were more economical of this kind of ornament, particularly in the Doric order, in which are found never less than sixteen, or more than twenty. The use of fluting in the Doric order is believed to be as old as the order itself; at least it is found in the most ancient remains. The Doric columns, according to Vitruvius, ought to bear twenty flutes. The Greeks made the flutes of this order very slightly concave, and cut them off short. The flutings of the Ionic and Corinthian orders differed from the Doric in number, form, and in their susceptibility of ornament: their number is fixed by Vitruvius at twenty-four, and sometimes thirty-two: their form is that of a semicircle, or more commonly of that segment of a circle contained by a side of an equilateral triangle inscribed in it. The flutes are separated in the Ionic and Corinthian orders by a listel, and not, as in the Doric, by a simple edge. The most common method of ornamenting the Ionic and Corinthian flutes is, to fill the cavities by a rudenture, which is sometimes cut in the shape of a cord. (See *Rudenture.*) The principal object of this ornament is to give solidity to the lower-part of the column, and to defend the sides of the flutes, which would otherwise be liable to be broken in the lower part by any outward accident. It must be observed, however, that rudented flutes ought only to be used in columns which rise from the ground, and not in those whose elevation on pedestals places them out of risk of being injured, or which are used in a second order; and also that the rudentures ought only to occupy the lower part of the flutes, because the motive for which they are used does not exist in the superior part of the shaft, whose elevation places the edges of the flutes out of danger. These observations apply equally to the Composite order. In the Tuscan order, flutes are seldom used; but when they are employed, the simplicity of this style allows only those of the Doric order.

Flyers, are steps in a series, which are parallel to each other.

Flying Buttresses. See *Arc Boutant.*

Folded Floor, a floor in which the boards are grooved and tongued, and laid down several at a time, with their edges forcibly brought together.

Folding Doors, are made to meet each other from opposite jambs, on which they are hung; and when they are rebated together, their edges meet, folding over each other, with a bead at the joint, to give the appearance of one entire door.

Foliage, an ornamental distribution of leaves on various parts of buildings.

Font, (*fons*, Lat.) a vessel in christian churches, of marble or stone, to contain the water of baptism. Baptismal fonts, of great antiquity, are yet to be seen in British churches; particularly that of Bridekirk, in Cumberland, which is believed of Danish origin; and one of antique appearance, lately removed from the church of St. Peter in the East, in Oxford. The date (1340) is inscribed on the font of St. Mary's Church in Lincoln; and there is one covered with ancient sculptures in Winchester Cathedral. In King's *Munimenta Antiqua*, and in the *Archaiologia*, several of large dimensions are described, and represented by figures.

Fontana Dominico, an eminent architect and mechanic, was born at or near Milan, in 1543. Early in life he fixed his residence at Rome, with his elder brother John, both together pursuing the study of architecture; he was employed by Cardinal Montalto in the great work of the chapel of the Manger in the church of St. Maggiore; and on the Cardinal's becoming Pope, Fontana was appointed his architect. Besides many other great works, he completed the dome of St. Peter's, and, as a singular and splendid embellishment, raised up in front of its piazza, the obelisk, an entire block of granite, which formerly belonged to the circus of Nero. This immense stone had been covered with earth and dust for ages, and though its erection had been projected, the attempt was deemed impracticable. Its accomplishment was therefore reckoned one of the greatest exploits of the age, and its author rewarded with honours and emoluments. Fontana made considerable additions to the Vatican, and built its Library. After completing his great work of the aqueduct, to convey water from a distance of fifteen miles to the city of Rome, he was engaged as architect to the king of Naples; and in 1592 removed to that city, where he died, whilst engaged in making a new harbour, in the year 1607, in the 64th year of his age.

Foot, (Sax.) a measure of twelve inches, each inch being three barleycorns. The standard English foot, as authorized in the 31st of Edward I. is 12 lineal English inches = 36 barleycorns, = 16 digits 4 palms, = 3 hands, = 5⅓ nails, = 1⅓ spans, = 1·5151 Gunter's links, = ·938306 feet of France, = ·3047 metres of France.

The French foot exceeds the English by nine lines and a half. The Scottish foot exceeds the English, as 185 of the former to 186 of the latter.

If we divide the English foot into one thousand parts, and the inches into 12 lines, the proportions of national feet will be as follows:—

	PTS.		FT.	IN.	L.
London Foot	1000	—	0	12	0
Paris foot, according to Greaves	1068	—	1	0	9·7
Do. according to Bernard	1066	—	1	0	11
The foot commonly used in France	1065·4	—	1	0	9·4
Amsterdam foot	942	—	0	11	3
Antwerp	946	—	0	11	2
Dort	1184	—	1	2	2
Rhinland or Leyden	1033	—	1	0	4
Lorrain	958	—	0	11	4
Mechlin	919	—	0	11	0
Middleburgh	991	—	0	11	9
Strasburgh	920	—	0	11	0
Bremen	964	—	0	11	6
Cologne	954	—	0	11	4
Frankfort on the Mayne	948	—	0	11	4
Spanish	1001	—	0	11	0
Toledo	899	—	0	10	7
Roman	967	—	0	11	6
Bononia	1204	—	1	2	4
Mantua	1569	—	1	6	6
Venice	1162	—	1	1	9
Dantzic	944	—	0	11	3
Copenhagen	965	—	0	11	6
Prague	1026	—	1	0	3
Riga	1831	—	1	9	9
Turin	1062	—	1	0	7
The Greek	1007	—	1	0	1
Old Roman	970	—	0	0	0

Cagnazzi, by a scientific examination of the monuments of antiquity found in Herculaneum and Pompeii, has ascertained that the ancient Roman foot was 0·29,624 of a metre, or 131,325 lines French measure.

Foot Bank, see *Banquet.*

Footing Beam, the name given to the tie-beam of a roof in some parts of the country.

Footing, of a wall; a projecting course of stone at the base of a wall or building, intended to give stability and support.

Footing Dormant; the same as tie-beam of a roof.

Foot-pace, a flat part in a stairs, or hand-railing, between the first step and the landing place.

Fores, (Lat.) among the Romans, the doors which opened toward the street: when they had two folds they were termed *bifores;* sometimes each fold was again divided, so as to make four, when they were termed *quadrifores.*

Fore-shorten, a term applicable to drawings or designs, in which, from the obliquity of the view, the object is represented as receding from the opposite side and the plane of the projection.

Fori, (Lat.) the seats that were

arranged in gradation one above the other in the Roman circus.

Form, the name given to the long seats or benches placed in the naves of ancient churches before the introduction of *pews*. The name is supposed to have been derived from the sculptured or painted figures, called *formæ et typi*, with which they were ornamented.

Fortification, is the species of architecture termed military, used for defence against the attack of an enemy; showing how to fortify a place with ramparts, parapets, moats, and other bulwarks. The fortifications of antiquity were constructed of trunks of trees mixed with earth, and afterwards, when battering-rams, catapults, and other instruments of attack were invented, thick walls of stone or brick were used.

To oppose the attacks of assailants with fire-arms, *modern fortification* requires ramparts, towers, and bastions, with numerous outworks. They are in the form of regular polygons, and called *Regular Fortifications;* or, from peculiarity of situation, and other circumstances, their sides and angles are not uniform, and they receive the name of *Irregular Fortifications*; these are generally of a temporary description, for the defence of an army on the field of action, and are called *Field Fortifications*, constructed of sand-bags, earth, and fascines, ten feet long and one foot thick, made of faggots of wood; or, instead of these, when wood cannot be got, a wall of turf raised upon the parapet supplies their place.

A very ingenious mode of fortification, applicable to ships as well as to land forts, to protect them against the destructive effects of cannon-ball, was communicated to the Register of Arts by Lewis Gompertz, Esq. of Kensington, and is fully described in the second volume of the new series of that work, with an illustrative engraving; and it is also described in Jamieson's Dictionary of Science, vol. i., page 330, with an account of numerous experiments made by the inventor. The chief advantage of this invention is in its application to merchant vessels and ships of passage; but for ships of war, as it could be adopted by both parties, its effects would be *neutralized*,—though it seems that in this case it would save the men from injury, and would always be in favour of the weak, its nature being that of defending itself, and returning the blows. The attempt appears worthy of encouragement, as affording an excellent defence of the weak against the assaults of the strong.

The fortifications of ancient Athens, as well as all its public works, were upon a splendid scale; beside the Acropolis, the City and the Piræus, with Munychia, were respectively fortified. The two latter embraced a circumference of eight English miles, with walls sixty Grecian feet high; they were built of square stone without cement, joined together with iron cramps. The city and the harbour were also connected by two long walls, the longer of which was equal to forty stadias, or five English miles—the shorter, to thirty-five—built upon a marshy ground raised with stones. To these were added, in time of war, ramparts of earth, trenches, and parapets, for the strengthening of the works, together with the fortifications of the smaller places in Attica. See *Acropolis*.

Fortress, (*fortresse*, Fr.) synonymous with *Castle*, which see, and also *Arabian Architecture*.

Forum. By this name were designated the public places where the markets were held at Rome;

they were also used for public assemblies of the people for public affairs, elections, courts of justice, and were found in various towns of the Empire, as *Forum Livii*, *Forum Julii*, *&c.* Amongst the Greeks. the market-place, or Forum, was called *Agora*, and was generally in the middle of the town. In large towns each quarter had its *agora*, and in towns situated on the coast, or a navigable river, the *agora* were usually near the port. The form of the Grecian *agora* was generally square, surrounded by porticos, and by the principal public edifices, as temples, &c. and ornamented with statues, as those of Methana in the Corinthian territory, Gytheum in Laconia, Coronè in Messenia, described by Pausanias. In the agora of Sparta was the house in which the council of the elders met, and at the side the dwellings of the Ephori, and other magistrates. The agora of Elis was of great antiquity, and was distinguished from those of the other cities of Greece and Ionia, by its porticos being pierced with streets. The forum of the Romans was generally an oblong square, the breadth two-thirds of its length. As they were often used for the combats of gladiators, the porticos were larger, so that the intercolumniations and galleries served also as shops for the merchants, and as counting-houses for the changers and receivers of public moneys. There were fourteen fora at Rome, of which fourteen, called *fora venalia*, were destined for mercantile purposes; the other three, termed *fora civilia* or *judiciaria*, being used for public assemblies, and for the administration of justice. The greatest and most celebrated forum at Rome, was the *Forum Romanum*, which occupied the place between the Palatine mount and the Capitoline, now called *Campo Vaccino*, and which being the most ancient, was sometimes termed *Forum Vetus* or *Latinum*, or simply *the Forum.* In it was situated the comitium, and other public buildings, and it was, till the time of Julius Cæsar, the only one in Rome. Many of the *fora* received their names from their builders, as the *Forum Nervæ* and the *Forum Trajani*; others from the particular purpose for which they were destined, as the *Forum Boarium*, which was a market for cattle, and was adorned by a bronze statue of a bull, the *Forum Piscarium*, or fish-market, *Forum Pistorium*, or bread market, *Forum Suarium*, or swine market. Several modern architects, as Perrault, Galliani, Palladio, Piranesi, and M. Durand, have published conjectural plans and elevations of these fora, in which they are probably very little exaggerated, and we may conceive from them a tolerably just idea of the disposition, size, and grandeur of these splendid works, in which utility was blended with all the richness and pomp of architectural ornament.

The *Meidan* of Ispahan is a very large modern forum, surrounded on all sides by lofty galleries, and on festal days is adorned with richly coloured tapestry. See *Ispahan.* On the remains of the agora of Athens. See *Agora.*

FOUNDATION, (Fr.) that part of a building or wall which is below the surface of the ground. The ancients in the foundations of their edifices followed somewhat different rules from those of the moderns. On a rock the foundation was commonly not above two feet deep, but in castles they generally made the depth of the foundation one-sixth of the height of the edifice above the ground. The foundation walls were on each side half a foot wider than the walls above, and were composed of large stones strongly cemented. Counter forts were raised on the outside of them, and in the interior other walls were constructed, united to the principal walls, and projecting from them like the teeth of a saw: the angles were connected by diagonal walls. In their foundations, the Romans sometimes used puzzulana mixed with lime, and thrown into the foundation fosse. On this was placed a range of stones; and alternately a range of each followed, till the required height was completed.

If the ground to be built on was unsound or marshy, it was directed to be cleaned out, and piles of alder or scorched oak driven down very close together by powerful machines, and the interstices rammed with coal. If vaults and arches were to be made under the ground-floor, they must rest upon a foundation broader than themselves and of a compact and solid structure.

The architect, well aware of the great importance of a good foundation, will be anxious to find or to make it such. A rock, or a compact sandy earth, of a firm consistence and rocky, make a natural foundation, either on land or in water; and if on land, and no cellars be required, it will be sufficient to dig a sixth part of the height of the building. If the building be in water, all the sand and gravel must be removed till a firm foundation be found, or if that cannot be done, piles must be driven and an artificial foundation made. In soft and loose ground, the foundation must be proportionably wider; and also when the fabric to be erected is very spacious. Stones laid level without mortar at the bottom of the trenches, are best for the first course, and these should be close packed together, and the broader the better. With builders in general, it is a rule to make the foundation course twice the breadth of the thickness of the wall.

In foundations near the edge of waters, or where trenches have before been made, the ground must be carefully examined to a considerable depth. Previous to laying the foundation, it will be necessary to make drains for carrying off the rain or other water, that would otherwise collect and lodge about the house. In forming these, large allowances must be made for the different quantities that may be collected at various times, and it must be considered, that vast quantities of sediment will be collected, and soon choak up the drain, if it be of contracted dimensions; to prevent this, it will be necessary to make cavities in various places, into which the sediment will collect; these are called *sess-pools*. These drains ought to be arched over at the top, and may be most conveniently built of brick; and according to their different sizes, the following proportions of height and thickness may be observed. If the drain be eighteen inches wide, it may be one foot in height, and in thickness nine inches; the bottom paved with bricks laid flat, and the arch turned four inches. If the drain be twenty-two inches wide, the side walls are then to be one foot three inches in height, and the rest constructed as before. A drain of a yard wide should have the same height, and the arch turned over it ought to be nine inches thick. Drains of different dimensions may be constructed by the same proportions.

The sewers and drains being finished, the foundations of the walls must be laid; great care being taken that the foundation floors be perfectly smooth and level. The Italian builders begin by laying over it an even covering of strong oak plank, and upon that they lay, with the most exact care, the first course of the materials. Whether we take this method, or begin upon the naked floor, all must be laid with the utmost accuracy by rule and line. The first course of stone must be large, and laid without mortar; for lime would make the wood decay, which otherwise, in a dry soil, will remain entire for ages.

In a loose soil, and where there are to be apertures in buildings, such as doors, windows, &c. it will be best to turn an inverted arch under each; which will effectually counteract the mischief which would arise from the stress of the incumbent weight—the piers carrying the arches with them as one solid body, pressing equally on the sub-soil of the foundation. The parabolic curve is recommended for the form of these arches; but they should never be less than a semicircle.

As walls rise from the first course, they are diminished equally on each side. The outward and interior walls of a building must rise from the same level. Inverted arches must be built under all apertures, except those of very contracted dimensions. The bearings of chimney-breasts must not be outwards—they must diminish as they rise from the footing and the face of the outward wall. New-made earth must not be laid against new-made walls. Old foundations must not be built on without careful examination. All stones in building, especially in foundations, must be laid as in the quarry. See *Bed* and *Face of a Stone.*

Fountain, a building out of which water is made to flow, for the supply of towns and cities: in ancient Greece they were to be seen in almost every town, and some of them highly ornamental. The Pirene, a fountain of Corinth, was enclosed with white marble, formed into elegant grottos, from which the water flowed into a capacious basin or reservoir, of the same material. A second fountain at Corinth was called Lerna, whose beautiful portico overshadowed ranges of elegant seats, on which, in the extreme heat of summer, the citizens might enjoy the cool air. Pausanias mentions a fountain in the sacred wood of Esculapius, at Epidaurus, of great beauty. He also describes many others equally distinguished; among which were those called Arsinöe and Clepsydra, at Messina. France, at Paris boasts of the fountain of the Thuilleries, at Versailles of that of the Orangery, and various others, splendidly, if not tastefully, decorated. At Rome are the fountains of the Villa Aldobrandini at Frescati, of the Terminus, of Mount Janiculum, of the gardens of the Belvidere in the Vatican, the three Fountains of St. Paul, and many others of great celebrity. See *Basin* and *Cantharus.*

Fountaineers. See *Aqueduct.*

Foutchou Fou. See *Bridge.*

Fox-tail Wedging, is a peculiar mode of mortising, in which the end of the tenon is notched beyond the mortise, and is split, and a wedge inserted, which being driven forcibly in, enlarges the tenon, and renders the joint firm and immoveable.

Frame, the name given to the woodwork of windows, enclosing glass; the outward work of doors or window-shutters, enclosing panels; and in carpentry, to the timber works supporting floors, roofs, ceilings; or to the intersecting pieces of timber forming partitions.

Franking, a term used by the makers of window sashes, and applied to the mode of forming the joint where the cross-pieces of the frame intersect each other.

French Architecture. The works built under the direction of Charles V. prepared the regeneration of architectural taste in France. Of this age, may be instanced the castle of St. Germain-en-Laye, and those of Montargis and De Créil. The church of St. Urbain at Troyes, built towards the end of the fifteenth century, is distinguished by its delicacy and solidity. From Charles XII. to Louis XII. little progress was made in the improvement of this art. Under the latter prince were erected the eastern and southern fronts of the castle of Blois, with the Palais de Justice, the castle of Gaillon, &c. In the reign of Francis I. architecture had still made very slow progress; he erected parts of the castles of Fontainbleau and St. Germain-en-Laye, and, on his return from Spain in 1526, Chamboid. It was during the reign of this prince that the taste for the Gothic style began to yield to the style which was introduced by the Italian artists whom his liberality encouraged. This is considered as the true epoch of the regeneration of pure architecture in France. The Italian and French artists emulated each other in furnishing the most magnificent designs for the erection of the Louvre, which was continued by his successor, Henry II. by whose orders considerable additions were also made to Chamboid, Fontainbleau, and St. Germain-en-Laye. From this period the architecture of France has proceeded through a regular train of progressive improvements, till it arrived at its present state. In the Plate of French Buildings, are exhibited the general style of French mansions in the metropolis. For more observations on the early architecture of France, see *Gothic Architecture.*

French Bridges. See *Bridge.*

French Casements, are window frames made to form two casements, one of which is fixed, and the other moveable, wrapping over each other, and forming a transom at their junction. The lower part, which hinges on the jambs, forms a munion where the two sides meet in the middle. A patent was granted in 1825 to J. L. Bond, of Newman-street, and J. Turner, of Well-street, London, for an improved sash of this construction.

Fresco, (Ital.) the most ancient method of ornamenting houses, by painting on stucco whilst that substance remains soft and fresh: this method of decoration is peculiarly applicable to great public works and splendid edifices, being the most durable; it is also the most expeditiously performed, and yet requires the greatest skill in its execution. The Egyptians practised stucco painting from a remote and unknown antiquity; and it is also found among the most ancient relics of Grecian art. Two operators are engaged, the painter, with the plasterer in constant attendance. To prepare the work for the painter, a rendering and a finishing coat are required, and the colours are prepared only with water. No alteration or amendment can take place, and the artist must possess great ability and judgment, with quickness of execution. This art has been lately revived by the French, with considerable success, an example of which is recently finished in the chapel of St. Vincent de Paule, in the church of

St. Sulpice at Paris, by a native artist of the name of Guillemot; it is the third chapel in that church which has been so embellished, and the effect is very beautiful.

Fret, a kind of ornamental work, which presents a rough or uneven appearance, formed by rectangulars of channelled work. The labyrinth fret is formed from winding channels, whose sides are parallel to each other, with right angles.

Frieze, (Fr.) that part of the entablature comprised between the architrave and the cornice, supposed to have originated from the projecting ends of the transverse beams resting on and fixed to the architrave. Amongst the ancients, the Tuscan order had no frieze, because the beams which rest on the architrave, and which in the other orders do not go beyond it, have so great a projection in this, that they form the cornice. When however the beams give place to a frieze, they are cut level with the architrave. In the Doric order the frieze was ornamented with triglyphs, which doubtlessly owed their origin to the same extremities of the beams resting on the architrave. They were placed at equal distances above the middle of the columns, and that of the intercolumniations. Thus there remained between the two triglyphs a square space called the *Metope*. In the other orders the frieze was ornamented with garlands of flowers and fruits, with figures of animals, (whence Vitruvius names it *zophorus*) men, of arms, of allegorical ornaments, &c. On the frieze of the temple of Jupiter at Elis, appears to have been sculptured the race of Pelops and Œnomaüs, though some suppose it to have been on the *fronton*. On the frieze of the temple of Apollo at Delphos were suspended the golden bucklers that were taken at the battle of Marathon. Stuart, in his Antiquities of Athens, has given a representation of a Doric frieze, supposed to have belonged to a temple of Ceres at Athens, whose two triglyphs are ornamented with the heads of poppies, with a torch and a thyrsus placed across. Winckleman has shown, in his treatise on the architecture of the ancients, that no member allows so great a variety of ornament as the frieze; it was often appropriated to an inscription, as in the Rotunda at Rome; and in some instances, small oval apertures to admit light are introduced on the frieze. On this subject, amongst other works, may be consulted *P. Columbani*, a variety of capitals, friezes, and cornices, and “Frises et Ornaments moderne, par *J. Le Pautre*.”

Frieze-Panel, the upper panel of a door of six panels.

Frieze-Rail, the rail next to the top rail of a door of six panels.

Frigidarium, (Lat.) an apartment in the Roman bath, supplied with cold water.

Frigiratory, an apartment, generally on the ground floor, or in the cellar, under-ground, well ventilated, and fitted for the preservation of animal and vegetable articles of food.

Front, (*frons*, Lat.) the name given to the principal anterior façade of a building: by the Romans peculiarly applied to temples, as was also the word *Anticum*.

Frontispiece, an ornamented front of a building.

Fronton. See *Tympanum*.

Frosted, a kind of ornamental work, having an appearance like that of hoar frost upon plants.

Frustum, (Lat.) a piece cut off from a regular figure: the frustum of a cone is the part that remains when the top is cut off by an intersection parallel to its base; it is also called a truncated cone. The frustum of a globe or sphere, is any part of it cut off by a plane; the solid contents of which may be found by adding three times the square of the semidiameter of its base to the square of its height, and then multiplying that sum by the height and this again by 15236, which gives the solidity of the frustum.

Funnel, the inside of the shaft of a chimney.

Furniture, the name given to ornamental plates of brass, or other metals attached to the fastenings of doors, windows, and on other parts of the wood-work of houses.

Furrings, are flat pieces of timber used by carpenters to bring dislocated work to a regular arrangement, by drawing the chief parts of it to one regular surface.

Fusurole, a small member in form of a collar, with somewhat long beads under the echinus, or quarter-round, of pillars of the Doric, Ionic, and Composite orders.

Fut, (Fr.) the shaft of a column; applied also to the trunk of a pilaster.

G.

Gable, (*gaval*, Welsh,) the upright triangular end of a building; in classical architecture, called a pediment. See *Carpentry*.

Gage, (Fr.) in carpentry, an instrument made to strike a line truly parallel to the straight side of any board or piece of stuff. Its chief use is for the gaging of tenons true, to fit into mortises; and for gaging stuff of an equal thickness. It is made of an oval piece of wood, fitted up on a square stick, on which it slides up and down, and on which there is a tooth, to strike a line at the distance required.

Gaieta, or **Gaeta**, the ancient *Cajeta*, a seaport town of Naples, 40 miles north-west from the capital. At the front of the cathedral is a fine antique white marble vase, of Athenian sculpture, with *bassi relievi*, representing Athamas, Ino with a child in her arms, and a group of Bacchantes. An ancient column, opposite the great portal, is marked with the names of the winds in Greek and Latin. The tomb of Munatius Planeus, which stands on a bold eminence on the neck of land which joins the peninsula to the continent, is round, but stripped of its marble casing, and converted into a tower with battlements. See *Eustace's Travels*, vol. i. p. 475.

Gain, the bevelled shoulder of a binding joist.

Galilee, a name given to the porch which was built at or near the west end of great abbey churches, where the monks collected on their return from any procession, and where corpses were deposited previous to their interment.

Gallery, (Fr.) an apartment of much greater length than breadth, often used as a connecting passage with which the various rooms of a building communicate. Palladio gives the proper length of a gallery at from eight to ten times its breadth. In modern palaces and mansions, the gallery, like the portico of the ancients, is appropriated to the reception of pictures and sculptures. The name is also given to long porticos, with ranges of columns on one side.

Gang-Ladder, a name used in canal-making, for the same purpose as a horsing block.

Gang-Way, a temporary stair of planks.

Gaol, (Brit. *geal*,) a prison, or place of confinement. It is always pronounced, and sometimes erroneously written, *jail*. In England, every county has two gaols; one for the peace, and the affairs of the crown, and this is properly the county gaol, the other for debtors.

Gard, Pont du. See *Aqueduct*.

Gardens, Hanging. See *Arch*.

Garland, (*Gardel Handa*, in the northern languages, *a nosegay artfully wrought with the hand*.) The word denotes ornaments of flowers, fruit and leaves, intermixed; anciently much used at the gates of temples, where feasts and solemn rejoicings were held, and as an architectural ornament, is frequent on triumphal arches, &c.

Garnets, Cross, a kind of hinge, in the shape of ⊢.

Garret, (Fr.) the upper story of a house.

Gate, (*geat*, Sax.) the door of a city, castle, or other large building. The city of Rome had originally but three gates, but after the admission of the Sabines as citizens, a fourth was added on the side of the capitol. The first gate was termed *Porta Mutionis*, from the lowing of the herds which entered by it; the second, *Romanula*, from the name of the city; the third, *Janualis*, from the temple of Janus near it; the fourth, *Porta Carmentalis*, from Carmenta, the Arcadian prophetess, the mother of Evander, who resided near it. Other gates were afterwards, at various periods, added. Leo Battista Alberti, (*de re edificatoria*, lib. viii. c. 6.) observes the similarity between the names and use of the gate (*porta*) and ports or harbours (*portus*): viarum quidem, et earum, quæ extra urbem sunt, et earum, quæ intra urbem sunt, caput, et quasi terminus quidam, est terrestribus porta: maritimis nisi fallimus portus. The gates of ancient cities were formed with an opening in the middle for carriages, &c., and one smaller on each side for foot passengers, as may be observed at Pompeii. In temples, the lintel, or architrave of the gate, was always the same height as the capitals of the columns of the portico. The gateways were sometimes wider at the bottom than the top, as in the circular temples of Vesta at Tivoli, and the Doric temple at Cora. Vitruvius denominates gates, according as they belonged to the Doric, Ionic, or Corinthian orders, *Doric*, *Ionic*, and *Attic*.

The gates of Arabian cities are generally of vast height, plated with brass on both sides. See *Arabian Architecture*.

In rural economy, the Gate is a frame of wood, constructed of bars, and turning upon hinges. Their width should be generally from 8½ to 9 feet, and the height five to six, the bars five or six in number, each four or five inches broad. Oak, on account of its durability, is the best wood for gates; but deal, willow, and alder, are often used, and are durable from their lightness. Where horses, &c. are kept, the upper bars are required to be strongest.

Gates, in engineering, are the doors of locks or sluices, on canals, &c.

A Gate, on the construction, hanging, and fastening of a turnpike-gate, has been invented by T. N. Parker, Esq.; a full account and description of which may be procured at Taylor's Architectural Library, Holborn. In this improved gate, an extraordinary degree of strength has been obtained with a moderate quantity of materials, and those materials so advantageously disposed, that the weight of the gate is thrown as near to the hinges as possible. The force required to open or shut this gate is equal to about eleven pounds; and when opened at right angles to the road, it presents no projecting obstruction of any description, and has no tendency to recoil, nor to rest in one part more than in another. The materials of this gate are oak and iron, and though the *principle* is not new, yet the manner of its application is peculiar, as respects both the upper and lower hinge; the weight on the lower is supported without either *wheels* or *rollers*, and yet it may be opened by a child of three years old; and the upper hinge may be extended or shortened by a screw-nut, to adjust it with the lower. The expense of this gate will be from about £12 to £20.

Gate, the *Sympathetic Park Gate*, is made to open on the approach of a carriage or horse, and to shut of itself when the carriage has passed through. This invention is by Mr. John Parker, of Knightsbridge, and is described in the London Journal of Arts, vol. xiv. 1827. The lever is the principle of action, and the weight of the horse or carriage is the propelling power, in the opening and closing of the gate.

Gathering of the Wings, is a name given by workmen to that part of a chimney which connects the breast with the flue.

Genesis, (*γενεσις*, Gr.) the formation of a line, plane, or solid, in geometry, by the motion of another.

Geneva, a city of Switzerland. The houses are lofty, consisting frequently of four or five stories; and in the commercial part of the town, particularly in the Rue Basse, gloomy arcades of wood are supported by large wooden pillars, which rise to the very top of the house, and protect the foot passengers from the sun and rain. In this street there are two rows of low wooden shops in front of the houses, separating the street from the foot pavements. The cathedral, which is a fine building, occupies the place of an ancient temple consecrated to the sun.

Geometrical Stair, a flight of stairs, supported only by the wall at one end of the steps.

Geometry, (*γεωμετρια*, Greek, from *γη*, the earth, and *μετροω*, I measure,) the science of extension, quantity, or magnitude, abstractedly considered. The oldest geometricians we read of in history were the Egyptians, to whom ancient writers attribute the invention of the science. One of its oldest cultivators in Greece was Thales, of Miletus. Among his followers were Anaximander, Anaximenes, Anaxagoras, and Pythagoras. It continued to flourish amongst the Grecian sages, and, amongst its most distinguished disciples in later ages, are numbered the celebrated names of Euclid and Archimedes. Amongst the best works on geometry, are, Euclid's Elements by Simpson, Legendre's Geometrie, and the works of Playfair and Leslie. The following are a few of the most useful practical problems:—

1. Given three straight lines, A,B,C, to find a fourth proportional. (*Plate* GI, *fig.* 1.) Make the angle *d e f* at pleasure, apply the line A on the side of the angle from *e* to *d*, and the line B on the other side from *e* to *f*, join *d f*; apply the line C on the line *e d*, from *e* to *g*, draw *g h* parallel to *d f*, meeting the side *e f* in *h*; *e h* will be the fourth proportional.

2. To find a mean proportional between two given lines. Draw a straight line AC, (fig. 2,) and make AB and BC equal to the given lines; draw BD perpendicular to AC from point B, or AC, as a

diameter, describe the semicircumference ADC, cutting BD in D: BD will be the proportional required.

3. To find in lines the square root of any proposed number, Draw the straight line AC (*fig.* 3,) equal to the proposed number, which may be supposed to be 35, which is the product of 35 × 1, or 7 × 5. Make AB equal to 35 parts of a scale, and BC equal to 1, and find the mean proportional BD to AB, and BC, by the last problem; or find bd (*fig.* 4,) a mean proportional between the lines ab and bc, which are equal to 7 and 5; the line BD or bd will be found equal to 5·916, the square root.

4. To reduce a given rectangle to another, which shall have one of its sides given. Let ABCD (*fig.* 5,) be the given rectangle: make the line I = AD, and K = AB, which being considered as the two middle terms, make H, as the first term, equal to the given line EP, and find a fourth proportion by prob. 1, which may be done on the angle DAB, and Ag will be the other side of the rectangle to be erected on EF, and equal to ABCD. (The scale at the bottom of the plates is given, to apply the lines of the figures to numbers.)

5. To reduce a given triangle to a rectangle of the same area. Let the given triangle be ABC, (*fig.* 1, *Plate* G. II.) take the side AB for the length of one of the sides of the rectangle, and draw the line CD from C perpendicular to AB, and bisect CD into equal parts, in the point i: draw EH = AB, and BF = Di perpendicular to EH, and complete the rectangle EFGH, which will contain the same area as the triangle ABC.

6. To reduce a triangle to a rectangle of the same area, of which one of the sides is given. Let the given triangle be ABC, (*fig.* 2,) and F the given side of the rectangle; G, H, I, are the three first terms of the four proportionals, H = AC base of triangle, and I = de, half the perpendicular Bd, and a fourth term ko may be found by the triangle lkm: construct the rectangle $pqrs$, of which the side ps = F, and $pq = ko$, and it will be equivalent to the triangle ABC.

7. To reduce a polygon to an equivalent rectangle, of which a side is given. Let it be required to reduce a pentagon ABCDE, (*fig.* 3, *No.* 1,) to a rectangle, whose given side is I. (No. 2.) As the figure consists of five sides, it may be divided into three triangles by the diagonals AC, AD: in the first triangle, V, draw the perpendicular Bf; transfer AC and the half of Bf to K and L, (*No.* 2,) for the two middle terms of which the first is I: find the fourth proportional mq by *No.* 3: the lines I (*No.* 2,) and mq, (*No.* 3,) are the sides of a rectangle equivalent to the triangle ABC: this rectangle will be $rswv$, (*No.* 8.) In the same manner the rectangle $stxw$, may be found, equal to triangle W, by *Nos.* 4 and 5, and the whole figure will be completed by $tuyx$ = X, by *Nos.* 6 and 7, the rectangle $ruyv$ being equal to the pentagon ABCDE. If the polygon be regular, a rectangle must be described equal to one of the triangles, and repeated as often as the number of triangles. In *fig.* 1, (*Plate* G. III.) the rectangle $rsgz$, *No.* 3, is made equal to the triangle FIE, (*No.* 1,) and the whole rectangular $rxyz$ is the rectangle multiple of the partial rectangle $rsgz$.

8. To describe a square that shall be any multiple of a given square. Let ABCD, (*fig.* 2,) be the given square, it is required to make one four times as large; draw the diagonal BD, and produce the sides

AB and AD to G and K, make AE and AH equal to DB, and complete the square AELH: next draw a line from D to E, make AF and AI each equal to DE, and complete the square AFMI: the square AELH = twice the square of AB, for the square of DB, which is equal to the square AELH, is equal to the squares of AB and AD, that is, twice the square ABCD; in like manner the square AFMI, being the square of DE, equals the squares of AE and AD, and the square of AE is twice the square of AD, therefore the squares of AE and AD, or the square AFMI equals the square of AD, or the square ABCD. For the same reason, the square AGNK, made in the same manner, is four times the square ABCD.

9. To describe a square nearly equivalent to a given circle. Let the given circle be ABCD, (*fig*. 3,) draw the two diameters AC, BD, at right angles to each other, bisect either of the four radii, as ED in *f*, and from A, the extremity of the radius perpendicular to FD, draw the straight line A*g* through *f*, meeting the circumference in *g*: A*g* will be the side of a square, whose area is very nearly equal to the circle ABCD.

Geranos, (Greek,) a machine placed behind the scenes of the ancient theatres, by means of which the actors might be raised into the air. The name signifies a *crane*, and it perhaps resembled in some measure the machine which still goes under that name.

Giant's Arch, a remarkable arch of the horse-shoe form, at Alora in Spain. See *Arabian Architecture*.

Giblea Cheque, a term used in Scotland for a recess made in a stone doorcase, by cutting away the right angle formed by the front and returns of the aperture.

Gilding, (*gilden*, Sax.) Many tracings of gilding and silvering are to be found on the earliest monuments of Egyptian art. Vestiges of it, as used by the ancient Persians, are found among the ruins of Persepolis. It was practised to a great extent among the Greeks and Romans, but not in their architectural works.

Gimlet, (Fr.) an instrument used by carpenters, &c. for boring holes.

Giocondo, an architect of Verona, in the sixteenth century, who visited France, built two bridges over the Seine, and obtained the title of architect-royal to the French king. He was first a teacher of languages. He was employed with Raphael and San Gallo, in superintending the erection of St. Peter's. He edited Pliny's Epistles, and Vitruvius, and published several architectural dissertations.

Girder, (Saxon,) a large beam, to shorten the joists of a floor, and thus lessen their bearing. It is also termed the *girding beam*. See *Carpentry*.

Girdle, (Saxon,) the circular band round a column.

Girgenti. See *Agrigentum*.

Glacis, (Fr.) an easy slope or declivity. In fortification, a sloping bank, more particularly that which ranges from the parapet of the covered way to the level on the side of the field.

Glass, (*glas*, Saxon,) a transparent substance, made by fusing various salts and metallic oxides with siliceous earths. The manufacture of glass was well known in Aristotle's time, about 350 years before Christ, and Pliny gives the following account of its discovery. A merchant vessel, laden with nitre or fossil alkali, being driven on the coast of Palestine, near the river Belus, the crew accidentally supported the kettles on which they dried their provisions on pieces of the fossil alkali. The sand about it was vitrified by its union with the alkali, and produced glass. The hint thus accidentally obtained was improved upon. The glass of Egyptian manufacture was long preferred to all other: it was often stained of various colours. In the time of Augustus it was used by the Roman architects in mosaic work, several specimens of which have been found in the villa of Tiberius, in the island of Capri, consisting of red, green, and blue. From Lactantius it appears, that about the end of the third century, glass was used for windows, (de Opific. Dei, c. 5,) and from the glass plates found at Herculaneum, we have reason to suppose that this practice was introduced much earlier. The use of glass in windows is mentioned by St. Jerome in 422, Paulus Silentiarus in 534, Gregory of Tours in 571, and Johannes Philoponus in 630. Artificers skilled in making glass, according to Bede, were brought into England in 674. Glass windows were not generally used in England till 1180, and for a considerable time they were esteemed marks of great magnificence.

GLUE. See *Cement*.

GLUEING UP various kinds of work, is treated of in the article *Constructive Carpentry*.

GLYPH, (γλυφις, Gr.) an ornamental cavity or incision. See *Diglyph, Triglyph*.

GNOMONIC PROJECTION *of the Sphere*, when the eye is in the centre of the sphere, and projects all the circles on a plane which touches its surface.

GODROON, (Fr) a kind of inverted fluting or beading,

GOLA, or GULA, (Lat.) a moulding, more usually denominated *cyma reversa*.

GOLDMAN, a German architectural writer, born at Breslau, in 1623, and died at Leyden in 1665.

GONIOMETER, (Gr. from γωνια, an angle, and μετρεω, to measure,) an instrument for measuring solid angles.

GONIOMETRICAL LINES, lines of sines, tangents, secants, or any other used to measure angles.

GORGE, (Fr.) another name for the moulding termed *cyma-recta*.

GORGONEIA, (γοργονεια, Gr.) key-stones carved in the shape of Gorgons' heads.

GOTHIC ARCHITECTURE. The origin of that kind of architecture which is commonly denominated Gothic, is hid in the mysterious darkness of a barbarous age. Of late times even the propriety of the name has been a subject of dispute. Some have considered it to have been introduced into Italy by the Goths, under Theodoric: others imagine it to be a corrupt deviation from the Grecian and Roman; and others conceive, from the similarity of the nave of a Gothic cathedral, to the interior of a grove of trees, with its interlacing boughs, that the style was formed originally in imitation of such a grove, from which all its ornaments originated. But all these theories are liable to important objections. As to the latter, it is evident that all architectural ornaments have originated from vegetable forms. Not a single instance of the pointed arch, or pinnacle, have yet been discovered in the ancient styles peculiar to Europe; and if we would pitch on any country as the original seat of Gothic architecture, we are induced, by many arguments, to look to India and Persia. Dr. Milner, and others, have suggested that the buildings which exhibit the Gothic arch in the East, are generally of an age posterior to its use in the West;

but this argument is neither true, nor of any weight. For supposing these Oriental buildings to be comparatively modern, yet it only proves that they were built in imitation of some ancient buildings, and it is very improbable that their builders would imitate the style of the Christians of Europe. In India, the pure Gothic arch is frequently found in buildings of undoubted antiquity. On the *Plate* (ATHENIAN ARCHITECTURE, A. 11.) *fig. a*, is a sketch of a fragment of the ruins of the ancient city of Gowr, on the Ganges, 170 miles north of Calcutta, which was built some centuries before the christian æra. It is supposed by Daniell, from whose views it is taken, to be a gate that has belonged to the fort. *Fig. b* and *c* are windows from the remains of a very ancient building, near Firoz Shah's Cotilla, at Delhi. The buildings of the emperor Akbar, from their general style, their arches, and their pinnacles, may be termed purely Gothic. The same forms are conspicuous in the ancient pagodas at Talicut. Specimens of the Gothic arch are frequent in various parts of Persia, at Cabul, and in the old palaces at Ispahan. They are even to be traced as far as China. In Arabia there are few antiquities, but in the modern buildings at Mocha, and other places, pointed arches are not uncommon, and they are frequently seen in the remains of Saracenic buildings described by Buckingham, in various parts of Syria and Mesopotamia. Mr. Haggitt states the occurrence of pointed arches, accompanied with inscriptions in the Cuphic characters, which were not used after the tenth century. It is highly probable, therefore, that the first principles of the pointed style were brought by the Arabs from India and Persia, and being by them carried into Spain, was afterwards adopted by the Spanish Goths, and, being mixed with the old style of the Romans and Normans, formed at last that style which has since gained the universal term of Gothic, which may be called, in the words of Mr. Knight, a corruption of the sacred architecture of the Greeks and Romans, by a mixture of the Moorish or Saracenesque, which is formed out of a combination of Egyptian, Persian, and Hindû. Mr. Bentham thought that the Gothic arch originated from the intersection of arcades of circular arches, often found in Saxon and early Norman buildings. Mr. Murphy, in his introduction to his history of the church of Batalha, considers the whole system of pointed architecture as founded on the form of a pyramid, to which the whole and every component part appears to bear a direct tendency. It may be mentioned in support of this idea, that in the pyramidal pagoda at Conjeveram, an exact resemblance of the Gothic arch is observed in all its ornaments. This building is of great antiquity, and its general architecture resembles that of the Seven Pagodas. (See *Pagoda.*) The pointed arch may also be traced in the Mahomedan monuments of the tenth century at Cairo, at Girgé in Egypt, and in the Arabian tombs of Negaddi and Zaoge. The open fretwork and the corbelling of the Arabian architecture, are acknowledged to have been borrowed from Persia and India. The remains of one or two Arabian buildings of the tenth century in Sicily, particularly one called Ziza, prove the existence of the pointed arch in early Mahomedan architecture.

In many very ancient English buildings, prior to the introduction of the pointed style, solitary examples are found of arches which approach in shape to the Gothic, but they appear generally to have occurred fortuitously. *Fig.* 14, (in *Plate* GOTHIC ARCHITECTURE,) is a very remarkable and ancient window from Brunless Castle. The horse-shoe arch is also found in very old buildings, as *fig.* 6, (*Plate* CASTLE, C, 65,) from the very ancient castle of Connisborough.

We will now proceed to describe the leading principles of the Gothic style. Of Gothic or pointed arches, there are three principal kinds: the simple pointed arch, which is struck from two centres on the line of the impost; the tudor arch, with four centres, of which two are on the line of the impost line; agée, with four centres, two on the impost line, and two on a line with the apex, the segments struck from the latter being reversed. The latter form is used principally in tracery and small work, and as a canopy or dripstone over doors and windows. The soffit is occupied by mouldings of various projections. The columns are never diminished, and are generally large, and surrounded by a number of slender shafts. The walls were at first made of an unwieldy thickness, to support the press of the arched roof; but their thickness was afterwards diminished, and the deficiency supplied by the use of buttresses. These are often divided into stages, diminishing in projection as they rise, and ending in a pinnacle. From the upper part of them spring insulated arches, serving as a protection for the clere-story. The steeple is generally a tower, square-topped, and crowned by a spire. At the angles are slender lofty turrets, containing the staircases. Turrets are also sometimes added to the corners of the building. The turrets are often crowned by spires. The exquisitely beautiful turret at the north-west angle of Peterborough cathedral is square, and decorated at the angles with boltels, which are carried up beyond it, and furnished by a triangular pinnacle. The spire in the centre is octagonal, and rectangularly placed within the square, four of its sides thus forming triangles with the boltels at the angles of the turret, which being arched over, form grounds for pinnacles of the same form, which are carried up to about half the height of the spire itself. Two of the Gothic mouldings resemble the *cyma-recta* and the *cyma-reversa* of the ancients. But the most peculiar moulding is the boltel, or cylindrical and nearly detached moulding, often answered by a corresponding hollow. *Fig.* 10 and 11, (*Plate* GOTHIC ARCHITECTURE,) are two forms of exterior drip-stones.

The principles of Gothic architecture, as has been already observed, appears to have been brought out of Spain, but it owes much of the beauties of its component parts, and the richness of its ornaments, to the Normans, amongst whom it was first introduced into the cathedrals of Seez, Coutances, and Mortain, in Normandy; then in the cathedral of Chartres, which was under Norman governance; and afterwards, on a more splendid scale, in the monastery of Clugnes, which was entirely rebuilt in 1093. No decided specimen of the pointed arch can be found in Normandy prior to 1080, about which time the cathedral of Seez was commenced, and partially built. The best preserved example of this early period is the collegiate church of Mortain, which was founded by Robert, Count of Mortain, brother-in-law of William the Conqueror, in 1082. At the commencement of the twelfth century, the adoption of this style of architecture became common, and, towards the middle, was used, to the total exclusion of the Norman, and its accessories. The styles of Gothic architecture in France and Normandy are distinguished generally into three periods.

The first style of Gothic architecture, from 1150 to 1240, is principally distinguished by its very pointed arches, and by its not having attained the bold elevation or lightness which subsequently characterized it. The doors are deeply recessed, with a succession of columns supporting an archivault formed of plain mouldings, sometimes with grimacing heads round the top. In this age was introduced a small door on each side of the large western one. The doors of country churches were all small, with merely a plain pointed arch. Windows, during the period of transition, were plain, pointed, and narrow, from whence they gained the name of lancets. Towards the end of the twelfth century, the windows began to be ornamented with a moulding round the outside; and at the beginning of the thirteenth, the idea was conceived of uniting these lancets, which gave rise to the construction of larger windows, containing two lancets within one main arch, the vacant space at the head being filled up with circles, trefoils, and quatrefoils. The columns during the first period began to be lengthened, clustered, and frequently encircled with fasces or bands, the capitals formed of flowers or foliage. The nave and aisles were narrow, separated by arcades of arches less acute than those of the windows, and covered with a vaulting in the form of an X, with a rose at the point of intersection. Buttresses were slender, and projected more than in the Norman style. In the latter part of this period they were divided into parts, or stages, the highest of which was surmounted with a little pinnacle, whilst the front of the lowest was pierced with a niche, to contain the statues of saints. At the same time were introduced *flying* buttresses, and spires, which were at first plain, and of an octagonal form. The best specimens of this style in Normandy and France, are the naves of the church of Eu and abbey of Fécamp, the cathedrals of Bayeux, Evreux, and the early part of that of Amiens, St. Genevieve, and the Saints' Chapelle at Paris, the churches of St. Denis, and St. Nicasius, and the cathedral of Rheims.

The second style of Gothic architecture, from 1240 to 1380, is particularly distinguished by the rectangular form of all its arches, and embraces the most brilliant epoch of its history. The style is in general appearance chaste and harmonious, all its forms are regular, its members uniform, and judiciously proportioned. The decorations are tasty and elegant; and though they are numerous, their arrangement is regulated with due regard to use, and the collocation appropriate. The walls being less massy during this period, the doors are less deeply recessed, but larger, more highly finished, and formed of more graceful arches, surmounted with triangular pediments, whose tympanums, as well as the piers below, are headed with a variety of little figures. The windows are wider, and additional lancets are introduced; the interior divisions, called mullions, assume a more slender appearance, and are sometimes delicately fluted, in the form of grouped pillars, with the heads ornamented with flowers. About the beginning of the thirteenth century, trilobed, rose, and, in private houses, bow windows, made their first appearance. Rose windows were at first simple, ornamented with trefoils and quatrefoils, united by flowing tracery; afterwards they were formed of an elegant assemblage of branch tracery, radiating from the centre. The columns are more delicate and elevated than before, the capitals shorter, but richer in foliage. Clustered pillars are sometimes found under a single, plain, round capital. A species of ornament, called *crocket*, was popular during this period, composed of a curled piece of foliage, placed at the angles of spires, canopies, turrets, buttresses, &c. The buttresses are more projecting, ornamented with tablets, with richer niches, and crowned with crocketed pinnacles. Tabernacles are very peculiar to this period, and at the commencement of the fourteenth century became most gorgeous Gothic appendages. The ribs, in the vaulting of the naves and aisles, are multiplied, and branch out into a great variety of tracery. Spires are richly crocketed, longer and more delicate, terminating frequently with a bunch of foliage, or a flame, called *finials*. Parapets are considerably richer and more open, formed of panels and roses, enclosing trefoils, quatrefoils, &c. The tracery is frequently mingled with oak leaves, which now begin to be used. The most remarkable specimens of the second style are the late parts of the cathedral of Amiens and St. Denis, the church of St. Ouen at Rouen, St. Sepulchre at Paris, and St. Stephen at Caen.

The third, or florid style of Gothic architecture, lasted from 1380 to about 1500. During this period, Gothic architecture by degrees degenerating into fantastical refinement, unmeaning and useless ornament, arches suffered a general depression, until at last they almost entirely lost their pointed character. The most remarkable characteristic is a gorgeous exuberance of decoration. The great source of ornament is pierced paneling, which is richly traced with foliage, and exhibits more gaudiness than elegance. Every variation of parapet, pinnacle, and buttress, are now in use, the latter very projecting, and loaded with statuary, heraldic insignia, &c. Various parts of the summits, particularly the angles, are ornamented with round cupolas. A remarkable character of the latest productions of this style, is the extreme depth and delicacy with which all ornaments are wrought on the stone. Windows begin to lose the elegance of their form and proportions; they are multiplied considerably along the lateral walls, and widened, for the introduction of additional lancets, with a very obtuse arch. The divisions in the head display, instead of roses and trefoils, a variety of undulating forms, and the mouldings of the arches are sometimes festooned with foliage, particularly the leaves of endive, vine, thistles, and broccoli. Portals too mark this style. They are invariably surmounted with a square head, or pediment, whose spandrils are ornamented with foliage or sculpture.

In porches, a drip-stone and rich battlement parapet crown the whole, with richly canopied lateral niches, flanked with buttresses, and terminated with a group of four pinnacles. Arcades are of a very compressed form, and the imposts of the arches often repose only on consoles, covered with richly grouped foliage

The ornaments of the vaulting constitute a series of intricate panel tracery, and richly frosted fretwork introduced between the groinings. Sometimes a radiating cluster of ribs or nervings springs from the summit of the columns, branching out on the roof in the form of a fan. This style of decoration was multiplied by degrees to great excess, and at the central points of union, are displayed immense masses of richly ornamented stonework, called pendentives, which descend frequently to a considerable depth. The first period of this style may be seen in the churches of Alençon, Argentan, Le Treport, and Harfleur; and the chapels, porches, &c. of many other churches. Of the second period, are part of Notre Dame, of St. Stephen, and St. John, at Caen, the hall of justice at Bayeux, and parts of many churches and buildings at Rouen. The most elaborate and delicate workmanship is exhibited in the mortuary chapels, monumental screens, and canopied tombs.

The pointed arch was first used in the ecclesiastical buildings in England, towards the close of the reign of Henry I; during those of Stephen, and Henry II. its use became more frequent. Parts of the following structures are characteristic of the style practised at this early period. Buildwas Abbey, Shropshire, begun about 1135; remains of the priory church at Dunstable, reign of Stephen; abbey church at Romsey, Hants, Lanthony abbey, Monmouthshire, founded in 1136; and the north side of the nave and choir of St. David's Cathedral, S. Wales. The introduction of this style into England was very gradual, and in some instances pointed arches are found mixed in the same building with those of the Saxon and early Norman. The Gothic architecture in England, as on the Continent, has been divided into three distinct styles. The first style, generally denominated the *Early English*, commenced with the reign of Richard, in 1189, and continued till about 1300, including the reigns of Richard I. John, Henry III. and Edward I. The second, or *Ornamented English*, from 1300 to 1460, beginning near the end of the reign of Edward I. and including, Edward II. and III. Richard II. Henry IV. V. and VI. The *Florid English*, from 1460 to 1537, the time of the dissolution of religious houses, including Edward IV. and V. Richard III. and Henry VII. and VIII.

The *Early English* style, is chiefly distinguished by its long narrow windows and bold ornaments and mouldings. The head of the window is generally the lancet arch, and sometimes the trefoil. In large buildings, two or more are generally found combined, with their drip-stones united. When combined, a quatrefoil is commonly inserted between the heads, and when many, the whole is sometimes covered by a segmental pointed drip-stone. In large buildings, the windows are frequently decorated with slender shafts, which are usually insulated, and connected by bands with the wall. The circular, rose, or catherine window, is frequently found in large buildings of this style, worked with great care. Doors are distinguished by their recess, being usually placed in a deep hollow, with a simple pointed arch, the columns insulated in a deep hollow. They are sometimes divided by one or more clustered shafts in the centre, with a kind of four-leaved flower as an ornament above. The steeples were often adorned with finely proportioned spires. They have usually ribs at the angles, which are sometimes crocketed. In some instances the spire is surrounded with bands of quatrefoils. Buttresses are common additions at the angles of the tower, though octagonal turrets, with pinnacles, are sometimes met with. The slope of the spire in some churches projects over the wall of the tower, which is finished by a cornice. The piers are surrounded with bands, sometimes confined to the shafts, and sometimes continued to the pier, the capital being usually composed of plain bold mouldings. In *Plate* GOTHIC ARCHITECTURE, *fig*. 12 is a capital of this style, and *fig*. 13, a base. The plan of the piers is generally a circle, surrounded by small shafts. *Fig*. 6 is a beautiful variation from Salisbury Cathedral. The buttresses are simple, have few sets-off, and rarely any ornament in their fasces. The flying buttresses were not used till late. The ornamental works of this period are distinguished for their boldness, and contempt of refinement. The most peculiar ornament is that denominated the *toothed ornament*, which resembles a low pyramid, of which the sides are pierced in the form of curvilinear triangles bending inwards; it is usually placed on a hollow moulding, and is sometimes entirely detached, except the angles. The principal specimens of this style are, during the reign of Richard I. the north side of the west transept of Rochester Cathedral, the chapel of the Holy Trinity at Canterbury, the upper transept and choir of Lincoln cathedral, and part of the nave and aisles of that of Peterborough. During the reign of John, the Galilee of Ely cathedral, part of the east end of that of Winchester, the remains of Beaulieu priory, Hants, the choir and transept of the cathedral of Rochester, and the nave and central tower of that of Lincoln. During the reign of Henry III. the pusbytery of Ely cathedral, Westminster Abbey church, the tower and western front of Wells cathedral, the whole of Salisbury cathedral, the transept of Worcester cathedral, and the transepts of York cathedral.

The windows of the *ornamented* style of English Architecture are distinguished from those of the preceding period by being larger, and divided into lights by slender upright stones, called mullions. In some cases, the mullions branch out into geometrical figures, and are all of equal size and shape; in others they are dispersed through the head in curves of various descriptions, which is called flowing tracery. In windows of more than three lights, the principal mullions form simple figures, subdivided by inferior ones. The principal mullions are faced by slender shafts, with bases and capitals. The flowing tracery will be understood by the sketch, *fig*. 9, of a window from the nave of York cathedral. The architraves are enriched by mouldings, which sometimes resemble columns, and the windows often reach from pier to pier. The arch is generally either the equilateral triangle, or more obtuse. The dripstone is improved into an elegant canopy, in form either pedimental, or an ogee arch, and is decorated with crockets and a finial, and the space enclosed between it and the exterior contour of the arch filled up with tracery. The circular window was also brought to perfection in this style. The doors differ less from the last period; they are not so frequently double, and the shafts are not detached; in small doors, the mouldings of the arch are carried down the side, instead of columns. There is frequently no base moulding. The steeples differ little from the preceding style. In the groining of the roofs, the merely decorative ribs are not often used, that from pier to pier, with longitudinal and transverse ribs, being most frequently used alone. At their intersections are placed bosses or sculptured ribs. The lancet arch is rarely met with; the tudor but in one instance, the nave of Winchester cathedral. The mouldings are less numerous, but bolder. In small works, the ogee arch is frequently formed, decorated with crockets, and a finial, as in *fig.* 3, which represents the top of one. The piers are square in their general form, and placed diagonally. Two variations are shown in *fig.* 4, from Exeter cathedral, and *fig.* 5, from the nave at York. The shafts are sometimes filleted. The capitals are frequently enriched with foliage, as in *fig.* 11 and 12, from Westminster Abbey and Hall. The bases consist often of reversed ogees. Buttresses are richer in the building, and are usually finished by pinnacles. The flying buttress is most common. The parapets are sometimes horizontal and sometimes embattled, each of which are frequently pierced in the form of cinquefoil-headed arches, quatrefoils, and triangles. Sunk panels are more common. Crockets and other ornaments were brought to perfection during this period. *Fig.* 2, represents the upper part of an ogee canopy, with crockets, or small bunches of foliage, running up the side, and a combination of two or more, called a finial, separated from the others by a moulding at the top. The best specimens of this style are in the reign of Edward I. and II. several parts of Exeter cathedral, St. Ethelbert's gatehouse and the cloister, in that of Norwich, the Lady chapel, of Litchfield cathedral, and the nave of York minster. Under Edward III. the octagon and lantern of Ely, the choir of Carlisle, and part of the transepts, choir, and cloisters of Gloucester cathedral, St. Alban's abbey church, part of St. Mary Redcliffe, Bristol, the choir of St. Mary's at Warwick, and St. Stephen's chapel, Westminster, now the House of Commons. Under Richard II. and Henry IV. and V. great part of the nave and the college, at Winchester; the nave, chapter house, and part of the cloisters, at Canterbury; some remains at New College, Oxford; and the tower and spire of St. Michael's at Coventry. Under Henry VI. King's College chapel, Cambridge; Beaufort's chancery, in Winchester cathedral; the chapel of the Virgin, in that of Canterbury; the Divinity school, Oxford; and Beauchamp chapel, Warwick.

The last style of gothic architecture, the *Florid English*, or *Perpendicular*, is distinguished by its superfluity of decoration, and uncompromising minuteness. It is marked most strikingly by its windows, the mullions of which are carried perpendicularly to the head, instead of finishing in flowing lines. They are also distinguished by a transom or cross mullion, to break the height, under which is usually a feathered arch. The architrave has seldom shafts or moulding, but is worked plain. The arch of the door is frequently finished by a horizontal moulding, continued to the springing of the arch, and then turned shortly; it is called a *label*, and the space enclosed between it and the exterior line of the arch, the *spandrel*. The steeple is extremely rich; spires are seldom, but lanterns frequently, used. The exterior angles are usually concealed by octagonal turrets, but sometimes supported by buttresses. In the groining, a number of small ribs, diverging from a centre, are carired up in the form of one side of a pointed arch, and terminated at equal distances from the centre by a semicircle; as they recede from the point, they are divided by smaller ribs, and these again subdivided so as to make all the panels of nearly equal size, which are ornamented with feathered arches; the interval between these semicircles are filled with tracery of the same description. This exquisitely beautiful kind of roof is called *fan* tracery. Arches in general are very round, and the Tudor arch is the most common in late works. The piers are much deeper than broad, and a shaft runs up the front to support the groining. The capitals are generally composed of plain mouldings, with sometimes a four-leaved flower in the hollow. Parapets are generally embattled and pierced. The general ornaments of the perpendicular style is nothing but a series of vertical panelling. A beautiful small ornament, often used, is called the *Tudor flower*, and is a series of square flowers, placed diagonally, and frequently attached, connected at the bottom by semicircles. The best examples of this style are under Edward IV. and V. and Richard III.; George's chapel at Windsor; the Honiton chapel, Devon; part of Charing church, Kent; St. Lawrence's, at Norwich; and the chapel on the bridge, at Wakefield. Under Henry VII. Bishop Alcock's chapel, Ely, Walden church, the Lady chapel, in Gloucester cathedral, part of Cirencester church, Bishop Waynflete's chancel in Winchester cathedral, St. Mary's, Oxford, and the churches of Dunster and Great Malvern.

In *plate* ATHENIAN ARCHITECTURE, A. 10, we have given a sketch of the form of the Gothic arch as observed at various periods. *Fig.* 1, from Ely cathedral, is of the eleventh century. *Figs.* 2, 3, 4, 5, 6, from Ely, are of the twelfth. 7, 8, from Ely, 9, from Durham cathedral; and 10, a lancet arch from Merton church, Cambridge, are of the thirteenth. 11, 12, and 14, from Ely, and 13, an arch of Edward III. are the 14th; 15 is an arch of Hen. VI.; 17, one of Hen. VII. and 16, one from Ely; all of the fifteenth. 6, is a horse-shoe arch, from Canterbury. In the twenty-seventh plate to the article *Carpentry* are given plans, sections, and bases of window mouldings from Westminster Abbey; on plate C, XV. *fig.* 4, crockets and finial from John of Gaunt's Palace, Lincoln; and on the plate GOTHIC ARCHITECTURE, *fig.* 1, ornament of a buttress from Lincoln cathedral.

Mr. Willis, in his History of Mitred Abbeys, gives the following relative proportions of Gothic buildings:

"In most of the stately abbeys, the height was equal to the breadth of the body and side aisle.

"The steeple and towers were frequently built equal in height to the length of the whole fragment, or rather the cross-aisle from north to south, as is the case in Bristol, Chester, and St. David's;

"The cross-aisles often extend half the length of the whole fabric, as did the nave or western part, viz. from the great door at the west end, to the lower great pillars that supported the steeple;

"And the side aisles were just half the breadth and height of the nave, insomuch that both added together exactly answered it."

GOUFING FOUNDATIONS, a term used in Scotland for the mode of securing unsound walls, by driving wedges or pins under their foundations. The term is taken from a Scottish game called *Golfing*, in which a ball is driven with clubs, through two distant holes.

Gouge, a chisel of a semicircular form.

Gradetto, *Gradetti*, see *Annulets.*

Grain, in wood or stone, is the line of direction in which they may be most easily split transversely. Miners in reference to stone use various terms to signify the grain, or splitting direction of stones, as *beat*, *lamella*, *stratula*, *sheet*, &c.

Granada; for a description of its architectural peculiarities, see *Alhamra.*

Granary, a building to preserve grain, &c. Vitruvius terms buildings for the preservation of grain, *granaria*, those for hay, *fænilia*, and those for straw, *farraria.* Amongst the Romans, the granary made part of the *villa fructuaria*, (see *Villa.*) It always occupied the higher rooms, and had a northern aspect. Its roof was sometimes vaulted. The floors of granaries were generally either paved with small bricks, or covered with earth trodden down. The walls were covered with clay, beat up with dregs of oil, and mixed with olive leaves. On the northern side were excavated small windows or air-holes. The term *horreum* was applied by the Romans to buildings not only for the preservation of corn, but for various other effects.

Grand Staircase, in extensive buildings, the principal staircase receives this name.

Grange, anciently meant a barn and its apurtenances, and was an important part of the establishment belonging to abbeys,

Grange, New, a remarkable antiquity in Ireland. It is a large mound or pyramid, surrounded by a circle of stones, 25 miles from Dublin, and near the town of Drogheda. The gallery is 62 feet long, and the arms of the cross or transepts 20 feet each. A cupola over the centre is formed of long flat stones; projecting in gradation like tiles, and meeting in the centre, like one of the openings to the great Egyptian pyramid: see *Cave.*

Granite, a genus of stones, much used in buildings, composed chiefly of quartz, feltspar, and mica, forming rough and large masses of very great hardness, striking fire with steel, and receiving a good polish. Someties garnet, basaltes, and indurated steatites are found imbedded in its composition, which is formed of particles, visible and distinct. Not decomposed by acids, and only imperfectly and slowly calcinable in a great heat. The most stupendous ranges of mountains on the globe are of this stone, of which there are three distinct species, and many varieties. White granite or moor stone, is white, interspersed with a few large black spots, and crystalline quartz. It is much used in London for the steps of public buildings, and on other occasions, where great strength and solidity are required. This and its varieties are found in Ireland, and also in Cornwall and Devonshire. The Scottish granite from Dundee and Aberdeen, is remarkable for its excessive hardness, and much used for bridges, and works requiring great strength and solidity. Red granite, sometimes yellowish, and generally interspersed with black mica, is found in Devonshire, and at Mount Edgcumbe there are fine tables of it, equal to the finest Oriental granite; it is also found in other parts of England, in various countries of Europe, and abundantly in Egypt and Arabia.

Black granite, with dark green tinge, is frequent in the old pavements of London, and on the sea shore.

The pale whitish granite, variegated with black and yellow, is more frequently found in loose nodules than in strata, and is much used in paving streets. Almost every country produces these stones, and in many places they are found immensely large, of which the largest known is near the Cape of Good Hope, in Africa. This remarkable mountain, on account of its magnitude, is called the *Tower of Babel*. Granite takes a good polish; hence the Egyptians formerly employed it, and the Italians yet use it, for working large pieces of ornamental architecture; for which purpose it is particularly well adapted, as it is not liable to decay in the air. Indeed, there are columns, statues, and other monuments of antiquity, formed of granite, which have withstood the powerful and continued action of the weather during the vicissitudes of 4,000 years.

Graticulation, is the dividing a design or draught into squares, for the purpose of reducing it to smaller dimensions.

Græcostasis, a hall or portico adjoining the Roman comitia, in which foreign ambassadors waited before they entered the senate, and whilst the senate deliberated on the answer that was to be given them.

Grecian Architecture. From the period of its invention, in its progress to perfection, architecture must have experienced those gradations to which every art is necessarily subject. The first rudiments of that style which has since been the admiration of all civilized nations, has been supposed to be drawn from Syria and Egypt. The Sidonians, whom Homer characterises as Σιδόνες πολυδαιδαλοι, as "skilful workmen," were the same who erected for Solomon the temple of Jerusalem. But with the Greeks all the arts soon lost the character impressed on them by their first teachers; and the obligations of Grecian architecture to the practice of Syria or Egypt, are limited to the mere mechanism of the art. The main object of building, in the first stage of society, was security. Hence arose the disproportionate and astonishing exertions bestowed on the walls, the remains of which are so common in different parts of Greece, and which, by their more polished descendants, have usually been attributed to the agency of supernatural power, as the works of gigantic Cyclopeans. Of these remains, Tiryns and Mycenæ are among the most ancient and most celebrated. (See *Acropolis* and *Cyclopean Buildings*.) The same motives which led them to employ this incredible labour in defence of their cities, influenced the more powerful individuals in the measures adopted for the preservation of their wealth. Treasuries were common in Greece at a very early period. Minyas, who ruled the Bœotian Orchomenos, considerably before the era of the Trojan war, is said to have been the first who erected a building for this purpose, and his wealth is celebrated in the Iliad; in the passage in which Achilles rejects the offers of Agamemnon, even although accompanied by all the riches enclosed in the "stone mansion of Apollo," it appears highly probable that Homer alludes, not, as is generally understood, to a temple, which there is reason to believe did not exist at that time, but to some treasury, which, from the manner of building employed in these edifices, might well deserve the characteristic appellation of λαινος. (See

Arch.) Among the architects employed in these edifices, are preserved the names of Agamedes and Trophonius, (see *Agamedes.*) In the time of Homer, the parts of architecture, properly termed ornamental, appear to have been unknown in Greece; the chief decoration of his age, consisted in a smooth polished surface: the stones were large, and well fitted together; but the charm and grace of forms were unknown. But to compensate for it, no exaggeration is spared to make them rich; we have brazen walls, and golden doors, with silver and ivory posts and lintels. The mansions of the heroes of the Homeric age, whose chief recommendation was solidity and extent, were built round a court, on the same plan as was universally adopted in later ages. The chambers in general, with the exception of the great hall of the palace, were small. The seats and couches were frequently distinguished by their costly materials and beautiful workmanship, but the chief decoration consisted probably in the magnificence of the arms, and in the skilful manner in which they were arranged. It is impossible to fix precisely the era of the introduction of the two grand distinctions in architecture, the Doric and Ionic orders. Perhaps the most ancient example of their existence, may be found in the account given by Pausanias of the Sicyonian treasury at Olympia, built in the thirty-third Olympiad, or about six hundred and fifty years before Christ, in which were made two chambers worked with brass, one Doric, the other Ionic, (see *Doric* and *Ionic.*) As the Doric style continued with few exceptions, to be generally adhered to by the European states of Greece until the time of the Roman conquest, the examples still remaining are numerous. One of the most ancient is the temple of Jupiter Panhellenius at Ægina, which is said to have been built before the Trojan war, (see *Ægina.*) The temple of Jupiter at Olympia, is supposed to be as old as six hundred years before the Christian era; and the remains of the Doric temple at Corinth prove it to have been a work of remote antiquity. Next in order of time, we may class the Grecian cities of Italy, which may be arranged in the following chronological order—Syracuse, Pæstum, Selinus, Segesta, and Agrigentum, (see these Articles.) The city of Selinus, whose stupendous ruins are the admiration of modern times, was founded by a Greek colony from Megara, about the year 650, A.A.C. The character of the magnificent edifices of which vestiges remain, combined with historical data that may be collected, prove them to be at least as old as five hundred years before our era. The Corinthian colony which established itself at Syracuse, is said to have been as ancient as the middle of the eighth century before Christ, and the remains of the temple of Minerva in the Ortygia, or that part of the city which was first inhabited, bear every mark of the highest antiquity.

Immediately next to these, in the relation of time, come the Athenian temples. Here we may pause on the full perfection of art; after this period nothing was added; perhaps in the course of a few years its gradual decline commenced. The dates of these buildings are accurately fixed: Mnesicles began the Propylæa in the eighty-fifth Olympiad, and the Parthenon was built a few years after. The temple of Theseus may be considered as coeval with the buildings of the

Acropolis. See *Athenian Architecture*, and *Acropolis.*

One of the noblest efforts of Ictinus, the architect of the Parthenon, and perhaps of the temple of Minerva at Sunium, is to be seen in the temple of Apollo Epicurius in Arcadia, which, although still nearly entire, has been little explored, or even visited. The extensive ruins of Messene, built sixty years after the death of Pericles, prove that the art had not yet suffered any material deterioration. The walls of this city, which are in many parts still entire, and may be traced through the whole extent of their ancient circuit, present the most beautiful and perfect specimen of the military architecture of the Greeks, being fortified and adorned with numerous towers and gates. But, as we may judge from the proportions of the portico of Philip in the isle of Delos, which must be as ancient as the hundred and tenth Olympiad, the architecture of Greece in a very short time experienced a considerable change. The portico of Augustus, at Athens, is supposed to be the most modern specimen of the Doric order in Greece, after which it gradually yielded to the Ionic and Corinthian.

The Ionic order appears to be as old as the Doric, but was confined at first chiefly to the Asiatic states The earliest specimen, of which remains are to be found, is the temple of Juno at Samos. Its introduction into Sicily may be traced in the tomb of Theron at Agrigentum, which has Ionic columns and capitals, surmounted by a Doric entablature. The beautiful octostyle temple of Bacchus at Teos, was built by Hermogenes of Alabanda, probably soon after the Persian invasion. The temples of Minerva Polias and Erechtheus, at Athens, was erected during the Peloponnesian war. The temple of Apollo Didymeus, near Miletus, does not appear to have been built before the hundredth Olympiad; and the temple of Minerva Polias, at Priene, was dedicated by Alexander. From this period to the Roman conquest, no specimens of the Ionic order are known to exist.

The Corinthian order is of comparatively recent invention. The first examples of this style in Greece appear to have been produced during the last few years of the Peloponnesian war. It was introduced in the temple of Minerva at Tegea, when rebuilt by Scopas of Paros; and in the Choragic monument of Lysicrates, which was erected in the hundred and eleventh Olympiad. Many of the ornamental theatres, so numerous in Asia Minor, may perhaps be referred to a period considerably before the Roman conquest; the most remarkable amongst those of the Corinthian order, are those at Laodicea on the Lycus, and Patara on the coast of Lycia. The Roman conquest spread the Corinthian style throughout Greece, almost to the exclusion of every other; and although the buildings of the period which followed, are often more splendid and costly, they are deficient in the pure taste and correct design of preceding ages. See *Order.*

Greek Cross. See *Church.*

Greenhouse, or *Conservatory*, is an horticultural erection for sheltering tender exotic plants from the injurious effects of our variable climate, especially during the winter season. The length of greenhouses will, of course, be proportioned to the number of plants they are intended to shelter; their depth should not exceed 12 or

16 feet in small houses; nor, in large ones, be more than from 18 to 20 feet. The windows should extend from one foot and a half above the pavement to nearly the same distance from the ceiling, so as to admit of a cornice round the building, over the tops of the windows. The floor ought to be of Purbeck stone, or flat tiles, elevated two, or, if on a damp situation, three feet above the ground; it will also be advisable to carry a flue about ten inches wide, and two feet deep, beneath the floor, through the whole length of the house, and to return it along the back part, where it should be carried up into funnels, for the purpose of discharging the smoke. The inner wall of the building ought to be covered either with stucco or mortar, in order to exclude the frosty air, and the shutters for the same purpose should be on the inside, and fold back upon the piers, that they may not intercept the sun's rays. The walls ought to be whitewashed, that they may the better reflect the light and warmth of the sun. As the front of the conservatory is usually placed south, the two wings should be south-east and south-west.

Grey Stocks are bricks of the third quality of the best, or marl-bricks.

Grit, (*grytta*, *greot*, Sax.) a fossil, sometimes forming a sandy substance, sometimes in the form of stones, of a friable texture; called also sand-stone. It resists the action of acids, but is permeable to water, and used for filtering stones. There is a kind of sand-stone, dug up in Derbyshire and other northern counties of England, which is used for whetstones, to sharpen knives, and various implements and tools.

Grit, *Argillaceous*, a stone of various degrees of hardness, mostly of a gray, sometimes of a yellowish colour, composed of a siliceous and micaceous sand, closely compacted by an argillaceous cement. It gives some sparks with steel, is indissolvable, or nearly so, in acids, and vitrifiable in a strong fire. It is used for millstones, and sometimes for building. Some of the varieties of grit or sand-stone with siliceous, micaceous, or sparry mixtures, constituted the puzzuolana of the ancients.

Groin, the angular curve made by the intersection of two semi-cylinders, or arches. Groins formed of cones, are called *conic groins*. Cylinders intersecting each other, form a *cylindric groin*. When two unequal cylindric vaults intersect each other, a *cylindro-cylindric groin* is formed. When the several axes of simple vaults form equal angles around the same point, on the same plane, what is termed an *equi-angular groin*, is the result. If three or more vaults join to form a groin, it is called a *multangular groin*. When the axis of the simple vault is in two vertical planes, at right angles, a *rectangular groin* results. A *spheric groin* is that which the intersection of two portions of a spherical vault produces. When the junction of cylindric with a spheric vault forms a groin, it is called a *cylindro-spheric groin*, if the spheric portion be of less height than the cylindric: but if the spheric portion be of greater height than the cylindric; the formation will be that of a *sphero-cylindric groin*.

Groined Ceiling, a surface formed by three or more curved surfaces, so that every two may form a groin, all the groins terminating at one extremity in a common point. The curved surface between every two adjacent groins, is called a *sectroid*: the point where the groins terminate is the *apex* or *summit*. The *reverse mould* of a sectroid is a convex surface, which exactly coincides with it; *equal sectroids* have the same reverse moulds. The *chord of a groin* is a line supposed to be drawn from the summit to the other unconnected extremity. A *regular groined* ceiling has all the sectroids and chords of the groins equal, and the unconnected extremities, in a plane. The *base* of a regular groined ceiling is a regular polygon, whose angles are the unconnected extremities of the groins. The *axis* is the line drawn perpendicular from the apex to the base. A *rectangular* groined ceiling consists of four equal sectroids.

When one of the side arches of a groin vault are given, to find the curve of the other side and angle rib, so that the groin lines shall be in vertical planes, passing through the diagonals on the plan. The rib of the other side, and that of the diagonal, may be described by the trammel, when the given rib is a semi-ellipsis, as in *Plate* I. Groin, To find the length of the jack ribs, let the plan of them be drawn, and describe a rib upon each opening, with the necessary breadth of stuff; from the extremities *a*, *c*, *e*, of the seats of the jack ribs, draw lines *a b*, *c d*, *e f*, parallel to the axis of its respective vault, and the same upon the other side, and continue them to meet the outer edge of the breadth; the parts *b b*, *d d*, *f f*, are the lengths or chords of the jack ribs on the semicircular side; their lengths on the other side are found in the same manner. To strengthen the joints of the ribs, they should be made of two pieces of wood of equal thickness, the angle ribs being so bevelled as to range with the side ribs in the following manner: Let *a b* be the plan between the ribs E and F, move the hip-mould parallel to the base, to the required distance, as shown by the plan, and draw a line by the inner edge of the mould. When the rib is the segment of a circle, as in *Plate* II. or any curve, the ribs may be described, as here shown at B, E, F, by the method given in the description of Plates in Descriptive Carpentry. To describe the ribs for the cradling of a cylindrical-cylindroidic groin, let N, O, P, Q, R, S, (*Plate* III.) be the piers, TMU the given arch, and TU its seat, and draw the diagonal *t u*, *No.* 1, and the ordinates GA, HB, IC, KD, LE, ME, of the arch TMU; draw also the ordinates *a g*, *b h*, *c i*, *d k*, *e l*, *f m*, *No.* 1, and the lines *a a*, *b b*, *c c*, *d d*, *e e*, *f f*, parallel to the axis of the side arch, and produce them to *g*, *h*, *i*, *k*, *l*, *m*: make the ordinates of *Nos.* 1 and 2 respectively equal to those of the given arch, and the curves traced through the points are the arches required. The other part of the figure represents the manner of fixing the timbers. To describe the intersecting or angle ribs of a groin standing upon an octagon plan, the side and body ribs being given both to the same height. In *Plate* IV. F is a given body rib, which may be either a semi-circle or a semi-ellipsis, and A is a side rib given of the same height, D is a rib across the angles, traced from E, the bases of both being divided into the same number of equal parts: from these points draw lines across the groin to its centre at *m*, and from the divisions of the base of the other rib D, draw lines parallel to the side of the groin; then trace the angle lines through these squares, which will give the intersecting ribs; draw the chords *a b*, *b c*, trace the moulds B and C from E or D, setting the ordinates from the straight chords *a b*, *b c*. To describe and back the angle ribs of a groin circular upon the plan, the side and body arches being given, as in the last. The construction is exhibited in *Pl.* V. The ribs may be described in the same manner, as in the last. E and F are the same moulds as shown at B and D. The side-rib A (*Pl.* VI. *fig.* 1.) and the angles being given straight upon the plan, to find the angle rib C, and the body rib C. The rib A is supposed to be placed over the straight line *a*, *b*, and its base divided into a number of equal parts, as 8, from the divisions draw lines to the centre of the groin, to intersect the angles at the points *a*, *b*, *c*, *d*, *e*, *f*, *g*, with the foot of the compass, in the centre of the groin, from the points *a*, *b*, *c*, *d*, &c. draw lines to the base of C, and make the ordinates of C equal to those of A; C is the body rib: draw lines at right angles from the points *a*, *b*, *c*, *d*, &c. and prick the moulds G and B from A, which will be the angle ribs required. To describe the ribs of a groin over stairs upon a circular plan, (*Pl.* VII. *fig.* 2.) Take the tread of as many steps as you please, suppose nine, from E, and the heights corresponding to them, and lay them down at F: draw the plan of the angles as in other groins, and take the sketch round the middle from *a* to *b* of the steps at E, and lay it from *a* to *d* at F: draw *d e* perpendicular to *b c*, and *d e* at B perpendicular to *c d*, and make *d e* equal to *d e* at F: draw the hypothenuse *e c*, and perpendiculars from *d c* up to B, and prick B from A, B is the mould to stand over *a b*, draw the chords *a* 4 and 4 *m* at the angles, make *a g*, 4 *h*, perpendicular to them, each equal to half the height *d e*, at B and F, draw the hypothenuse *g* 4, and *h m*, and the perpendicular ordinates from the chords through the intersection of the other lines that meet at the angles, then trace the moulds D and C, from the given rib A, which are there for the angles or intersecting ribs.

For the mensuration of groined ceiling, it is requisite to construct a rectangle, whose surface shall be equal to the surface of the ceiling. If the groined ceiling be rectangular, let ABCD, *fig.* 1. (*Pl.* GROIN VII.) be the plan, and let the arc AED be the intersection of the groined surface on the side of the wall, which is therefore supposed to be raised perpendicularly to the plan ABCD: draw the diagonals AC, BD, intersecting in *g*. Then the plans of the four sectroids are A*g*B, B*g*C, C*g*D, and D*g*A; the intersections of the other three arches upon the faces of the walls which stand upon the lines, AB, BC, CD, are the same as the arc AED: bisect the arc AED in E, and join EA and E*g*. Describe the rectangle GHUT, *fig.* 2, GH being equal in length to the arc AED (*fig.* 1.) and GT or HU equal to *f g* (*fig.* 1:) bisect GH in *k*, and draw *k* I, perpendicular to GH, making *k* I equal to *f g* (*fig.* 1:) divide either half DE of the arc AED (*fig.* 1,) and each of the straight lines *k* G and *k* H (*fig.* 2,) into an equal number of equal parts, as C. From the points of division in the arc DE (*fig.* 1,) draw lines parallel to E *g*, to meet the diagonal DB, and from the points of division in GH (*fig.* 2,) draw lines perpendicular to GH. Make the perpendicular on each side of *k* I respectively equal to the lines between D *f* and D *g* (*fig.* 1,) draw a curve through the extremities, then the triangle GHI (*fig.* 2) contained by the two equal curve lines

IG and IH, and the straight line GH, will be the exact covering over any one of the four planes of the sectroids. Find a third proportional to the length of the circular arc, as a first term, and the two middle terms each equal to the sectorial radius, by the operation at (*fig.* 3:) make I *l*, in I *k* (*fig.* 2,) equal to the fourth proportional: draw GT and HU perpendicular to GH, and through I draw TU parallel to GH, also through *l* draw *v w*, parallel to GH, meeting GT in *v*, and HU in *w*. The rectangle HG *v w* will be equal to the triangle GHI, and consequently equal to the area of one of the sectroids, or of one fourth of the whole ceiling. If PM (*fig.* 4.) equal GH, (*fig.* 2) and MN and PO (*fig.* 4) equal twice *k l*, (*fig.* 2,) the rectangle PMNO, will equal half the area of the ceiling. The area GHUT (*fig.* 2,) is that of a cylindric surface, whose arc is AED (*fig.* 1,) and the length of its axis *f g*: draw *g r* perpendicular to AB (*fig.* 1 :) make *g r* equal to the chord AE or DE, produce each of the diagonals to the points *a*, *b*, *c*, *d*, and through the point *r*, in the middle of one of the sides, complete the square *a b c d*, by drawing lines parallel to the sides of the square ABCD: the square *a b c d*, will be equal to the area of a dome having the same base and section as the groined ceiling. When the section AED is a semicircle, the area of the groined ceiling exceeds the area of the plan in a much greater proportion than in segments.

Let ABCDEF, *fig.* 1 (Pl. VIII.) be the plan of a regular semicircular cylindric groined ceiling, A, B, C, D, E, F, being the springing points of the groins. As all the vertical sections of each cylindric surface upon each side AB, BC, CD, &c. are semicircles, and as each cylindric surface is uniform, and the equal sides AB, BC, CD, &c. of the groined ceiling are diameters of the semicircular cylindric surfaces, the axis of each cylindric surface will bisect each of the sides, AB, BC, CD, &c. perpendicularly, and will meet the axis in the centre O of the hexagon. The groins will, therefore, be in the vertical planes, upon the diagonal lines AO, BO, CO, &c. We may now construct *fig.* 3, as before. Having drawn lines from the points in the half arc A *u* (*fig.* 1,) which divide it in equal parts, to meet the diagonal AD, and having drawn the corresponding line in *fig.* 3, make the ordinates from the points in *w x*, on each side of *k l*, (*fig.* 3) respectively, equal to the perpendiculars from AB to AO (*fig.* 1.) Make *w x* the first term of four proportionals, and make AE and AB the two middle terms: having found the fourth, as in *fig.* 2, make *m z* and *n y* (*fig.* 3) equal to it, join *y z*, and the rectangle *w x y z*, is equal to the surface of the groined ceiling over AOB (*fig.* 1.)

Important improvements have been recently made in the construction of ribbed groins, by Mr. Sappling, communicated to the Adelphi Society of Arts; a full description of which is also given in the Mechanic's Magazine of June, 1830.

GROOVE, or *Mortise*, the channel made by a joiner's plane in the edge of a moulding, style, or rail, to receive the tenon.

GROTESQUE, a singular and fantastic style of ornament, found in ancient buildings. See *Arabesque*.

GROTTO, an artificial cavern. (See *Cave*.) Wansleben was astonished at the immense number of artificial grottoes, hollowed in the mountains of Egypt. Said Ibn

Patrick imagined that they were the work of the Israelites, done by order of the Pharaohs. The people attribute them to the devil and to sorcerers. Many of them, perhaps, may be referred to the earliest ages of Egyptian history, when they served as dwellings for the then barbarous people. Artificial caverns in Greece were consecrated to the Nymphs. See *Catacomb*, and *Nymphæum.*

GROUND-JOINTS, are joints supporting the floor immediately above the ground.

GROUNDFLOOR, the lowest story of a building.

GROUND NICHE, a niche rising from the floor.

GROUND PLAN, an ichnographical outline, or drawing, of the foundation of a building.

GROUND PLANE, a line forming the ground of a design or picture, which line is a tangent to the surface of the face of the globe; as a *ground line*, is any straight line serving as the ground of the design.

GROUND PLATES, the outermost pieces of timber lying on or near the ground, and framed into each other with mortises and tenons. Mortises are also made in these, to receive the tenons of the joists, the summer, and girders; and sometimes the trimmers for the staircase and chimney way, or space, and binding joists.

GROUND PLOT, the ground on which a building is placed, *groundsel*, or *sil*, (*grund* and *sil*, Sax.) the same as ground plate.

GROUNDS: joiners give this name to narrow pieces of wood built in the foundations of walls, at the surbases of rooms, to secure architraves, and support the walls over apertures. They are of various dimensions, and covered in with plaster; or sometimes presenting a surface flush with the plaster.

GROUPED COLUMNS, are when three, four, or more columns are put together on the same pedestal: when two are placed together, they are said to be coupled.

GROUT, a thin kind of mortar, see *Mortar.*

GRY, a measure containing one tenth of a line. A line is one tenth of a digit; a digit one tenth of a foot; a foot one third of a pendulum, whose diadromes, or vibrations, in the latitude of 45 degrees, are each equal to one second of time, or one sixtieth of a minute.

GUAGE, for measuring timber.—The Silver Medal of the Adelphi Society was voted to Mr. James Broad for his invention of a Guage or measure for timber, which is described in the 14th vol. of the the second series of the Repertory of Arts for 1809. It consists of two pieces of well-seasoned wood joined near the middle by a pin, forming an axis on which they move, and has an index fastened to one of the arms, with the necessary contrivances to answer the intended purpose of enabling any gentleman or workman to make an exact estimate of the contents of trees or other timber, either before cutting down or in any other state. The Adelphi Society also presented the Silver Medal to Mr. R. Palmer, of Hackney, for an ingenious and useful invention of a Gauge for the purpose of marking a line along the centre of any parallel or inclined surface; also for finding the centre of a circle, square, or any regular polygon. This useful instrument marking a centre line with great accuracy, enables the workman to measure timber with ease. It will also greatly assist in making mortises, and answers all the purposes of a carpenter's common gauge. It will cost about 4s. Engravings, with a full description of this instrument, are given in the Repertory of Arts, vol. 25, for 1814. See *Gage*.

Guerite, a small tower of wood or stone, on the point of a bastion, or some other appropriate station for the use of the sentinel.

Guest Hall, see *Abbey*.

Gueule, *Gule*, *Gulæ*, *Gola*, are various modes of spelling this term, which is synonymous with *cymatium*.

Guildhall, the great court of judicature for London. In it are kept the Mayor's Court, the Sheriff's Court, the Court of Hustings, the Court of Conscience, Court of Common Council, Chamberlain's Court, &c. Here also the judges sit upon Nisi Prius, &c. The generality of borough towns and cities have a public building of this denomination for similar purposes. In some of the larger cities these halls are of considerable antiquity, or rebuilt in a modern style of architecture, large and commodious, for the transaction of public business.

Guillochi, (*Ital.*) ornaments in the form of a series of spiral strings.

Gulbe. See *Gorge*.

Gulphor, or **Gulphur**, the principal apartment in Arabian houses. See *Arabian Architecture*.

Gundulph, bishop of Rochester, toward the close of the eleventh century, the inventor of numerous important improvements in the construction of castles. See *Castle*.

Gurbies. See *Arabian Architecture*.

Guttæ, (Lat. *drops*,) ornaments of a conic form, on the cornice of the Doric order; they are supposed to represent drops of water.

Gutters, are a kind of canals in the roofs of houses, to receive and carry off rain-water. They are either made of lead or of tiles, which are either plain or concave; these last are called gutter-tiles, and so adapted to each other as to be laid with great ease. The Romans had gutters of terra-cotta along the roofs of their houses, and the rain water from them ran out through heads of animals and other devises, placed in the angles and in convenient parts. Leaden gutters were known in the middle ages.

Gymnasium. (Gr.) Amongst the public edifices of the Greeks, the gymnasia were classed in the first rank. It was in them that they instructed the youth in all the arts of peace and war, to make them useful and accomplished citizens. As long as they were carefully protected by the state, the sciences and the arts were cultivated with zeal. The name of *palæstra*, which properly designated that part of the gymnasium where they exercised their bodies, was sometimes applied to the whole building. At first the gymnasium was only an open space enclosed by a wall, as the ancient gymnasium of Elis mentioned by Pausanias: rows of plane-trees were planted, to afford shade from the heat of the sun. These trees, when the gymnasia were ornamented, and divided into compartments, gave place to colonnades and rows of pillars. The philosophers began by choosing a place to give their lessons, and built the *Exedræ*, where they collected their disciples. According to Ignarra, in his work *de Palæstrâ Neapolitanâ*, it was from this time that a difference was made between the *gymnasium* and the *palæstra*; as by the first name they generally designated the place appropriated to the lessons of the philosophers, and by the latter the place destined for the exercises of the body. Baths were added, as necessary appendages; and as the gymnasia degenerated, particularly among the Romans, they were regarded as the principal part of them, and the name of *gymnasia* was replaced by that of *therma*.

Vitruvius, in his fifth book, has given us a description of the distribution of a gymnasium. In a square or oblong space of two stadia in circumference, was built a peristyle, composed of four colonnades or porticos, of which three had but a single range of columns; the fourth, on the contrary, situated towards the south, had a double range. Sometimes, however, the double ranges appear to have been continued all round. Behind these porticos were different halls. On the side of the three simple porticos were the *exedræ* of the philosophers: under the double portico were the entrances to the places where the youth prepared for the exercises of the palæstra, and to the baths. In the middle of the halls was the *ephebeium*, at the side of which was the *coriceum*, next the *conisterium*, and at the angle of the portico the *loutron*, or cold bath. On the left of the ephebium was the *elothesium*, by the side of which were the *frigidarium*, the *concamerata sudatio*, the *laconicum*, and the warm bath. Under them was the *propnigeum* or *præfurnium*. The second part of the gymnasium had three porticos, one of which, looking towards the north, was very large, and had a double range of columns. Into this we entered on leaving the peristyle. The two other ranges, which were generally simple, ran to the right and left of the first, enclosing with the wall the area of the gymnasium. By the side of the wall and the columns, was a gallery or foot-path ten feet wide, which was destined for the use of the spectators. The space between the porticos was planted with trees. Near the porticos were open promenades, called by the Greeks *peridromes*, and by the Romans *xysti*, where the athleti exercised sometimes during the winter. At their extremity was a vast stadium, which afforded sufficient room for a great number of spectators, and in which were exhibited the public games. Such is the gymnasium as described by Vitruvius. But the form and disposition of the gymnasia varied in different places and in different times. The interior of these buildings were adorned with the most elaborate works in sculpture and painting. On the subject of gymnasia, the reader may consult, besides the work of Ignarra before-mentioned, Stieglitz's *Archäologie der Baukurst*. See *Circus*, *Hippodrome*, *Palæstra*, &c.

Gynæceium, or *Gynæconitis*, (Gr.) a part of the Grecian houses appropriated to the women.

Gypsum, calcareous earth saturated with vitriolic acid, therefore it does not effervesce with acids. Being subjected to a moderate heat, to expel the water of crystallization it forms plaster-of-Paris, and coming in contact with water, immediately assumes a solid form: of the numerous species of this fossil, alabaster is perhaps the most abundant. The plaster earth found in Glipston quarry, in Northamptonshire, is a dry, harsh, gritty, light yellow powder, which adheres to the tongue, but not to the fingers, and, mixed with water, immediately sets without previous heating. See *Alabaster*.

H.

Hacking, an inferior and imperfect mode of walling, to save stones.

Hadrianeium. See *Mausoleum.*

Halfmoon, in fortification, an outwork, having only two faces, forming together a salient angle, which is flanked by some part of the place, and of the other bastions.

Half-space, or resting-place, the space or interval between two flights of steps in a staircase.

Hall, (*hal*, Sax.) a name applied indifferently to the first large apartment on entering a house, to the public room of a corporate body, a court of justice, or to a manor house. Vitruvius mentions three sorts of halls; the tetrastyle, which has four columns supporting the ceiling; the Corinthian, which has columns all round let into the wall, and is vaulted over; and the Egyptian, which had a peristyle of insulated Corinthian columns, bearing a second order with a ceiling; these are called *oeci.* The length of a hall should be at least twice and a quarter its breadth, and, in buildings of large dimensions, three times its breadth. Its height may be two-thirds of its breadth; and an arched ceiling is to be preferred. In this case, its height is found by dividing its breadth into six parts, five of which will be the height from the floor to the underside of the key of the arch. In very magnificent buildings, where the hall is larger and loftier than ordinary, and in the middle of the house, it is called a Saloon; and a royal apartment is said to consist of a hall or chamber of guards, a chamber, an ante-chamber, a cabinet chamber, and a gallery. The great hall, where the courts of king's-bench, &c. are kept, exceeds in extent any hall in Europe, measuring in length 300 feet, and in breadth 100. See *Almahara*, *Basilika*, *Andron*, and *Cyzicenus.*

Halving, the junction of two pieces of timber, by inserting one into the other; in some cases to be preferred to mortising.

Ham, (Sax.) properly signifying a house or dwelling-place, also a street or village; hence Notting*ham*, Bucking*ham*, &c.

Hammer Beam, a beam in a gothic roof, not extending to the opposite side. A beam at the foot of a rafter.

Hand-railing. (See *But-joint*, *Carriage Carpentry*, *Constructive Carpentry.*) The art of forming hand-rails round circular and elliptic well-holes without the use of the cylinder, is entirely new. The new principle, the invention and perfection of which we owe to Mr. P. Nicholson, is fully described in the "New Carpenter's Guide." No previous author seems to have had any idea of describing the section of a cylinder through any three points in space, making a mould to the form of the section, and applying it to both sides of the plank by the principles of solid angles, so that by cutting away the superfluous wood, the piece thus formed might be made to range over its plan. The following is the theory of this practice. If we suppose any line to be drawn on the surface of the working cylinder, and the latter be to be cut entirely through from this line to the opposite surface, the line coinciding with the section made by cutting the solid through the line thus drawn, will be parallel to the base of the working-cylinder. Then, if the upper portion of the working-cylinder, separated from the lower, be to be removed, and the lower inserted in the well-hole, the surface of separation coinciding with the nosings of the steps, while the base rests on the floor; and if the whole be elevated to a certain height without turning, so that the base may be parallel to the floor, the surface of separation will form the top of the hand-rail in the square, and its two vertical sides will be a portion of the vertical surfaces of the working cylinder.

Suppose again, that another portion next to the top is again separated from the lower part, but not removed, so that the upper part may be every where of a certain thickness between the surfaces of separation, the portion of the working cylinder before formed still remaining in the same situation, the upper part thus separated would form the hand-rail in the square, and this the solid which we would wish to form, first in parts, and then put together in solid, constituting what is called the square rail, which is therefore contained between two opposite surfaces, which are portions of the surfaces of the working cylinder, and two other winding surfaces, contained between each pair of curves of the helix. The area which the base of the working cylinder would occupy on the floor is called the *plan of a hand rail*, and is bounded by two equidistant lines, on which each of the working cylindric surfaces stand erect, and the breadth of the space between these two lines is the *breadth of the rail*. If there be any sudden rise in the balusters, the top of the rail ought to be kept to the same height throughout, but should the height of the steps lead the top of the rail to irregularity in the curvature of the rail, the whole must be reduced to a uniform curve. To fix the rail as nearly as possible parallel to the line of the nosings, the top over the upper part may be depressed, and over the lower part elevated, half a step. Where the well-hole is very small, and winders necessary, the top of the rail must be kept higher over the winders than over the straight part.

Hangings, were originally invented to hide the coarseness of carpentry, or the cold and harsh appearance of stone walls; and that of tapestry, particularly the gold-embroidered, is attributed to Attalus, king of Pergamus, who died 621, A. U. C. making the Roman people his heir; at which period tapestry was first introduced into that country. The Anglo-Saxons had silken wall-hangings, with needle-work figures in gold, representing birds and other animals, and passages of history, real or fabulous. A Saxon lady has recorded the actions of her husband, to memorize his probity. The kind of hangings, called tapestry, was invented in Flanders, about the year 1410, and none or very little was manufactured in England till the reign of Elizabeth, when a highly ornamented kind, with figures of men in fantastic postures, like morris-dancers, was much used. Paper hangings were invented early in the 17th century; and leather was used for the same purpose, about the same time.

Hanging-stile of a door, is that to which the hinges are fixed.

Handspike, a lever for the purpose of carrying a heavy beam, or other burden requiring the strength of two or more men. When pieces of timber are used for this purpose, they are called *pudlais*.

Hard, signifies a ford, or passage, particularly used in fenny districts.

Hardening of timber for ship-building, by keeping for a long time at the bottom of deep waters, is an ancient practice, and said to answer the intended purpose.

Harness-room, a room in which the harness is to be deposited, near the stables; it must be dry and clean, and free from mouldiness.

Hassack, the provincial name for Kentish rag-stone.

Hatch, a slight erection of boards and slips of wood, for corn and other agricultural produce; also a hollow trap to catch weasels and other animals; or, a hatch is appropriated to the feeding of animals. In ships, hatches are a kind of trap-doors between the mainmast and foremast, leading from one deck to another, and the place they occupy is called the *hatchway*. Flood-gates in rivers and canals are sometimes called hatches.

Hatchway, the name given to the passage from one deck of a ship to another, through the hatches; applied also to the passage through a falling door to the top of a house.

Haunches *of an Arch*, see *Arch*.

Hawke, the board with a handle on its underside; used by the plasterer to hold his plaster.

Headers, in masonry, are stones extending over the thickness of a wall; and in bricklaying, the bricks are called headers, which are laid lengthway across the thickness of the wall.

Heading-courses, in bricklaying, those courses in which the length of the brick is across the thickness of the wall, are called heading-courses.

Head-stone, see *Key-stone*.

Head-way *of a Stair* is the clear distance measured from a given landing-place or stair to the ceiling; allowing for the thickness of the steps.

Headwork, a name given to ornaments on the key-stones of arches, frequently representing heads of animals, especially a stag's head above park-gates; in market-places, a bullock's or a sheep's; and over stables, the head of a horse.

Heart-bond, in masonry, is where two stones, forming the breadth of the wall, have one stone of the same breadth placed over them.

Hearth, among the Anglo-Saxons, was a heap of ashes or earth heated by fire, used for baking cakes, and other purposes: the Norman hearth was in the middle of the house; but when chimneys were introduced, in the 14th or 15th centuries, it was under the fire-place, for which the chimney was constructed.

Heather-roof, a covering to wooden buildings used in Scotland, especially in Argyleshire; recommended, as superior to straw-thatch.

Hebrew Architecture.—Whilst the Israelites sojourned in the desert, their temple, or, as it was denominated, tabernacle, was constructed of wood, and other materials, sufficiently light and portable to allow of its removal from place to place. And this was their only temple for a long time after their final settlement in Palestine. It was in the time of Solomon that the first grand temple was erected, and this work seems to have been executed under the superintendence of Tyrian architects. The details of this temple given in the bible are the only account left, by which we can form any idea of the architecture of the Hebrews. It was divided, like the tabernacle, into two parts by a partition of cedar-wood. Before the anterior façade was the *ulam*, probably a great gate, such as we see before many of the Egyptian temples, whose general construction has been supposed to bear considerable resemblance to that of Jerusalem. The latter temple appears to have had lead windows, resembling those observed in the ruins of the grand temple at Thebes. The roof appears to have been flat. The whole of the temple was enclosed by a wall, the space between which was occupied by a portico divided into three stages. Before the principal edifice were two courts, the first and largest for assemblies of the people, the second for the priests, whose dwelling surrounded it. Before the *ulam* were two columns, whose capitals, from the expression of the bible, that they resembled a rose spread out, appear to have resembled those of the Egyptians, which were generally a lotus flower. The walls of the temple were covered with figures of cherubim, palms, flowers, &c. David and Solomon were the authors of numerous other edifices, all executed by Phœnician workmen. See *Ægesta*, and *Order*.

HECATOMPYLOS, (Gr.) a name anciently given to the Egyptian city of Thebes, from its having a hundred gates.

HECATOMPEDON, (Gr.) a temple of a hundred feet in length, particularly applied to the temple of Minerva Parthenon. Mr. Stuart appears to have taken very great pains to discover the true length of the Greek *foot*, from different measures of the Parthenon, which, from its name Hecatompedon, was supposed to contain a measure of 100 feet in some very conspicuous part. According to the results of his inquiries, published by Mr. Reveley, the difference of the foot, taken from the various parts of the temple, is as follows:—

	Eng. Inch.
1. Length of the upper step in the front of the temple gives for one foot	12.139
2. From outside to outside of the angular columns	12.095
3. From centre to centre of the front columns	12.0983
4. From the Roman foot by my measure (Mr. Stuart's) of the Obelisk of Sesostris	12.11551
5. Length of the architrave	12.0625

This last Mr. Reveley has added, as Mons. le Roy has supposed that the length of the architrave might probably be 100 feet.

HECATONSTYLON, the name of a celebrated gallery at Rome, which was supported by a hundred columns.

HEEL *of a Rafter*, the end or foot that rests upon the wall-plate.

HEIGHT *of an Arch*, a line drawn from the middle of the chord, or spanning-line, to the intrados.

HELICAL *Line of a Hand-rail*, the line, or spiral line, twisting round the cylinder, representing the form of the hand-rail before it is moulded.

HELIOCAMINUS, (Gr. from ἥλιος, *the sun*, and καμινος, *a furnace*) a chamber in the Roman houses, so exposed to the rays of the sun as to be heated by it.

HELIOPOLIS, in Syria. See *Balbec*.

HELIOPOLIS, a city of Egypt, and one of the most ancient in the world. It was chiefly celebrated for its temple dedicated to the sun, part of which was consecrated to the breeding of the sacred ox, worshipped here under the name of Mneuis. It was also celebrated for its four obelisks, erected by Sochis, two of which were carried to

Rome, one destroyed by the Arabs, and the other still remains. Pococke observed the remains of the sphynxes in the way to the grand temple, but both are now buried by the soil. The obelisk is described by Dr. Clarke as one entire mass of reddish granite, about sixty-eight feet high, and six and a half wide. See *Dr. Clarke's Travels*, part ii. sec. 2, p. 98; also the *Travels of Norden*, *Shaw*, and *Pococke*.

HELIOTROPIUM, (Gr.) the name given by the Greeks to their dials or solar quadrants, which were also termed *gnomons*. Josephus asserts that Moses erected columns, which served to mark the line by the shadow projected at their feet. The Egyptian obelisks appear to have served the same purpose. This was therefore the first step towards the invention of the dial. Herodotus attributes its invention to the Babylonians and Chaldeans. The earliest mention of a heliotropium amongst the Greeks is that in the isle of Syros, which was said to have been constructed by Pherecydes. Five specimens of ancient solar dials are still preserved: (1.) That erected on the monument of Thrasyllus at Athens. See *Athenian Architecture*. (2.) One formed in 1751 at Castelnuovo, near Rome, and now preserved in the Capitol.—(3.) One at Tivoli, which was found among the ruins of the villa of Adrian,—(4) one found at Tusculum in 1741, and placed in the *Museum Contucianum*, and which has been illustrated by the works of *Jean Luc Zuzzeri* and *Roger Boscovich*,—and (5) one bought of a worker in marble, and described by *Pierre Lucatelli*. Their form varies much, some having a vertical position, others being horizontal; some of a cylindric form, others conic, others concave, and some hemispheric. The ancients had also portable solar dials in metal, which were termed *phorematica*, and of which a description is given by Baldini in the *Memoires de l'Alacadémie de Cortone*. On a silver vase found in the port of Antium, which was given by the chevalier Borgia to cardinal Corsini, and on which is represented the expiation of Orestes, we observe a dial placed on a quadrangular pedestal, as that dedicated to Diana by Colirius was placed on a column. A solar quadrant is also seen, supported by a square base on a bas-relief, published by Bartoli in his *Admiranda Romæ*, by Lamberti, in his *Villa Pinciana*, and by Visconti, in the *Museo Pio-Clementino*. See also Martini, in his book *Von den Uhren der Alten*.

HELIX, or HELYX, (*Helice*, Fr., from ἡλιξ, Gr. which signifies a kind of ivy, whose stalk curls,) a small volute or twist, representing the twisted tops of the acanthus stalk, placed under the floor in the abacus of the Corinthian capital.

HEM, the spiral projecting part of the Ionic capital.

HEMI, a Greek word, which signifies half, often used in the composition of architectural terms.

HEMICYCLE, (Gr.) a machine of the ancient theatres, mentioned by Pollux, which was placed near the orchestra, and served to represent what was happening at a distance, or on the sea.

HEMICYCLIUM, (Gr.) a chair whose back formed a half circle, and in which the ancients sat when they were giving instructions. According to Cicero, Scævola used one, and the Menander of the *Musée Napoleon*, No. 76, as figured in the third volume of the *Museo Pio-Clementino*, is seated in a hemicyclium.

HENDECAGON, a geometrical

figure with eleven sides, and as many angles. In fortification, it is a place defended by eleven bastions.

Heptagon, a geometrical figure of seven sides and angles.

Heptangular, having seven angles.

Hetaphonus, (Gr.) the name of a celebrated portico in the city of Olympia, which repeated seven echoes or returns of sound.

Heptapylos, (Gr.) a name given to Thebes in Bœotia, which had seven gates, in opposition to that of Egypt, which was termed *Hecatompylos*.

Herculaneum, called also *Herculanum* and *Herculeum*, an ancient town of Italy, on the bay of Naples, in the vicinity of the modern town of Portici. It is supposed to have been founded as early as 1250, A.U.C. and, according to Dionysius of Halicarnassus, it belonged successively to the Oscians, to the Cumæans, and to other very ancient people. The Romans appear to have gained permanent possession of the surrounding territory about 293 years before Christ; and it appears, from an inscription in honour of Lucius Manutius Concessanus, which was discovered in the neighbourhood, that it was made a Roman colony. According to the received opinion, this city, with Pompeii, disappeared totally in the famous eruption in the reign of Titus, A. D. 79. In a memoir read in the *Institut National*, and printed in the Magasin Encyclopédique, M. Dutheil has shewn that the existence of these cities may be traced up to the beginning of the fourth century, where they are mentioned as inhabited cities in the *Tabula Peutingeriana;* but in the Itinerary of Antoninus, neither of them is mentioned; and concludes that the eruption which destroyed them was most probably that of 471, when the cinders of Vesuvius were carried even to Constantinople. After centuries had elapsed, and all memorials of the unfortunate cities had been lost, a peasant, in digging a well beside his cottage, in 1711, obtained some fragments of coloured marble, which attracted attention. Regular excavations were then made, and some pieces of statuary were extracted from what afterwards proved to be a temple in the centre of the ancient Herculaneum. The king of the two Sicilies, twenty or thirty years afterwards, directed the subterraneous ruins of the ancient city to be explored, and the entrance is now gained by a narrow passage, descending gradually to more than seventy feet from the surface, where it branches into numerous alleys, leading to different streets and houses. All the streets are paved with blocks of lava, and run in straight lines, having generally an elevated foot-path along the side. The houses were of brick, not ornamented on the exterior, and of but one story. Among the public buildings which have been discovered are two temples, of which one, which was 150 feet by 60, contained a statue of Jupiter; opposite it was an extensive building, forming a rectangle of 228 feet by 132, (supposed to have been appropriated for the courts of justice,) surrounded by a portico, whose arches were supported by columns; within, it was paved with marble, the walls were painted in fresco, and bronze statues stood between forty-two columns under the roof. The theatre was found nearly entire, and had two principal gates, with inscriptions over their architraves, and seven entrances, called *vomitoria*, communicating with the benches. In the proscenium were found many columns and pilasters, with richly ornamented entablatures, and some supporting statues in bronze and marble; the walls covered with paintings in arabesque, and the floor paved with marble. Its greatest diameter, taken at the highest benches, is 234 feet, and it is supposed that it would contain ten thousand persons. Many interesting antiquities were found in the theatre and its neighbourhood; and in one place was found a skeleton, with a bag of money in its hand, as if in the attitude of escaping. The excavation was prosecuted along the walls of the buildings, which were entered by the doors or windows, as they occurred. A well was found, still containing good water, surrounded by a parapet, and covered by an arch: also, a bath of a circular form, and very ancient repositories of the dead. Columns of various coloured marbles, beautiful mosaic pavements, and statues perfect and mutilated, were found in abundance. When the antiquities discovered at Herculaneum, Pompeii, and Stabiæ became numerous, the king of Naples founded an academy, whose business it was to publish a description and explanation of them. This academy, however, did not last long. A *prodromus* of the antiquities of Herculaneum was however published by *Bayardi*, in 5 vols. 4to. The king, however, directed the publication of a more extensive work, which was accomplished in nine volumes, folio, in the course of thirty-eight years, from 1754 to 1792, under the title of *Antichità d'Ercolano*, and presented to the principal public libraries of Europe. Amongst these antiquities are found almost every article connected with the public and private life of the antient Romans, with immense numbers of statues, paintings, *basso relievos*, &c. A few of the manuscripts found at Herculaneum have been deciphered in part, with great labour and expense, and published under the title of *Herculanensia Volumina*. Other works which may be consulted, relating to Herculaneum and its antiquities, are—*Vinuti*, Descrizione delle primo Scoperte dell' Antica Citta d'Ercolano—*Murr*, de Papyris Herculanensibus—*Walpole* and *Drummond*, Herculanensia—*Hamilton*, Campi Phlegræi—*Hayter's* Letter, and Report on the Herculanean Manuscripts, in the Philosophical Transactions for 1751, 1753, 1754, 1755, 1756.—*Winckelmann*, *Fougeroux*, and *Cramer*, on Herculaneum, &c.

Herbosum, *Marmor*, a beautiful species of marble, of an exquisitely fine green colour, dug out of the quarries of Taygetus; it was highly esteemed by the ancient architects.

Herefordshire Beacon, the most perfect specimen of the triple-ramparted British camp. See *Celtic Architecture*.

Herisson, in fortification, a beam revolving on a pivot, and armed with abundance of projecting spikes, sharp-pointed, fixed before a gate or passage, to prevent the entrance of suspected or improper persons.

Hermitage, a little hut or habitation in a desert place, in which a hermit resides.

Hermogenes, a Greek architect, who invented the octostyle pseudo-dipteral form of temples; having omitted the innermost range of columns in the peristyles of dipteral temples, he diminished the number by thirty-eight, and thus reduced the labour and expense of building, at the same time rendering the ambulatory around the cella more spacious, whilst the outward appearance of the temple remained unaltered: *Vitruvius*, lib. i. c. 2.

Hermskirk. See *Cross.*

Heræum, (Gr.) any temple dedicated to Juno, particularly one near Mycenæ.

Herring-bone, see *Ashler.*

Herse, in fortification a portcullis in form of a harrow, fastened to a moulinet, and suspended by a cord, and rendered formidable to assailants, by projecting iron spikes. It is let down to guard the passage of the gateway on the enemy's approach.

Hexagon, a figure with six sides.

Hexahedron, in geometry, a solid figure with six sides, called also a *cube.*

Hexastyle, (Gr. *εξ*, *six*, and *στυλος*, *a column*) temples, &c. whose principal façade have six columns.

Hick-joint pointing, is distinguished from flat-joint or common pointing; the latter being no more than simply smoothing the mortar between the joints of a brick wall, as the courses are formed; in hick-joint pointing, a portion of a superior mortar is inserted, and made correctly smooth with the surface.

Hiding-places, in ancient buildings, places of this denomination are common, and a very curious hollow space in the wall, for the purpose of a hiding-place, is to be seen in a turret of Oxburgh Hall, in the county of Norfolk, which measures six feet long by five wide, and seven in height. The entrance is by a secret trap-door in the pavement, formed of a frame covered with bricks adjusted to the form of the pavement; this door rests on an iron axle in its centre, under which an arch passes to the secret recess. The door is so completely concealed, that it could never be discovered but by accident.

Hieron, see *Adytum.*

Hindu Architecture. The period of authentic history in India is comparatively of recent date.—Oude is said, in the historical poem called Mahabbarit, to have been one of the most ancient cities of Hindûstan, having been built in the fabulous ages of the reign of Krishna, which is placed about 2,500 years before the birth of Christ, and was believed to have been the birthplace of Rama. The extent of this ancient city is estimated in the *Ayeen Akbery*, (vol. ii. p. 41,) at 148 coss, or about 259 miles in length, and 36 coss, or 53 miles, in breadth. About 1000 years before Christ, the city of Canouge was built on the banks of the Ganges; and its walls, according to the Mahabbarit, were 87 miles in circumference. Major Rennel thinks that Canouge and Palibothra were the same. From the Ferishta and the Ayeen Akbery, the city of Delhi appears to have been founded about 300 years before Christ, and the latter states, that twenty princes of the name of Bal followed in regular succession for 437 years. Lahore, on the banks of the Raiwee, or ancient Hydraotes, appears to have been the Bucephalus of Alexander. Ayra, on the Jumna, in lat. 27° 15′, was Ptolemy's Agara, and was enclosed with an earthen wall by the Patan monarchs, but by the emperor Akbar it was raised to splendour, and surrounded with a wall of hewn stone.

The architectural remains of India, in style and construction, have a great resemblance to those of Egypt. The pyramids, the colossal statues, the obelisks, the sphynx, the numerous pits, and subterranean temples, with colossal figures, and the lion-headed sphynxes, discovered by Belzoni in Egypt, indicate the style and system of mythology to be akin to those of the people that formed the vast excavations of Ellora, Elephanta, and Canarah, and the various immense pagodas, pillars, and colossal images of the Indian idols. From the Ayeen Akbery, and Captain Wilson's article on Caucasus, (*Asiatic Researches*, vol. vi.) we learn, that in the Joubah of Cashmere, between Balkh and Cabul, in the numerous excavations, there are 700 places, where the figure of a serpent is carved, and that near these excavations there are carved in the rock, on the side of the mountain, figures of 15, 20, and even 80 ells high. Sir W. Jones identifies the Eswara and Isi of the Hindûs with the Egyptian Osiris and Isis, and thinks that the great statue of Narayen, or the Spirit of God, who at the beginning floated on the waters, as it now stands in the great reservoir of Catmander, the capital of Nepaul, differs only in name from the Cneph of Egypt. (*Asiatic Researches*, vol. i.) Another proof of a similarity of style between the ancient Egyptians and Hindûs, is their mutually using lofty spires or obelisks, like the pillar of Allahabad; there is a striking resemblance, too, between the Egyptian pyramids and the colossal brick building near the Gunduc river, in the Hadjipore district. It was visited by Mr. Burrows in 1785, who considers it to be evidently intended for the well-known symbol of the god Mahadeo, having originally been a cylinder placed upon the frustum of a cone, for the purpose of being seen at a distance. It is at present much decayed. Its dimensions are—diameter of column at base, 363 feet; height of conic frustum, on which the cylinder is placed, 93 feet; diameter of the cylinder, 64 feet; height of the remains of the cylinder or round tower, 65 feet; entire height, 158 feet. It is constructed entirely of well-burnt bricks. The pillar of Allahabad, as described by Captain Hoare is a lofty conical structure, covered with inscriptions, (*Asiatic Researches*.) But the resemblance between the architecture and mythology of India and Egypt, is applicable to most of the early tribes of mankind. Similar remains are found more or less in almost every part of the globe. The cylindric tower of India resembles the ancient round tower in Ireland. The ancient religion and the architectural remains of Ireland, as well as those of Britain, and various parts of the west of Europe, bear a remarkable analogy to those of the East. The pyramids of Egypt have narrow passages leading to dark chambers or temples under ground; at Benares, an ancient seat of Braminical learning, there are pyramids on a smaller scale, with subterraneous passages that are said to extend for miles. The caves of the oracle at Delphos, of Trophonius, and of New Grange in Ireland, had narrow passages like those of Egypt and India. New Grange is a large mound or pyramid, surrounded by a circle of stones, near the county town of Drogheda, about twenty-four miles north of Dublin. (See *Grange.*) On its first opening, a gold coin of the emperor Valentinian was found in it, which, Dr. Llhwyd observes, might bespeak it Roman, if its barbarous origin were not proved by a rude carving at the entry of the cave. See the articles *Pyramid*, *Mexican Architecture*, *Cholula*, *Cave*, and *Round Tower*

We will now give a brief sketch of the chief characteristics of the architectural works of the Hindûs. The royal palace of Agra was built in the form of a crescent along the banks of the Jumna. It was four miles in extent, and its walls were of very large stones, in colour resembling jasper. It consisted of three courts, each containing innumerable porticos, galleries, and turrets, all richly painted and gilt, and many of them overlaid with plates of gold. The first court was surrounded with shady arches; the second was surrounded by the apartments of the great omrahs and ministers of state; and the third contained the seraglio and the state apartments of the emperor, hung round with the richest silks of Persia, and behind these were the royal gardens. In a square which separated the palace from the city, a numerous army lay constantly encamped; and a larger area in front of the palace, towards the river, was occupied by the royal elephants. The columns of silver, and even of gold, and the other costly ornaments of the interior, are described in the travels of Tavernier and Mandesto. The foregoing description will give an idea of the public structures of more modern times, but it is among the pagodas and other sacred edifices that we must look for the pure ancient buildings of the Hindûs.

The first kind of sacred edifices we shall notice is the pyramid. It has been supposed that pyramidal structures on the plains, served the same purpose as the excavations of the mountains. But pyramids are not unfrequently found within the mountain caves. The pyramids of Deogur and Tanjore partake much of the nature of the cavern, their entrances being very small, and the interior being lighted by means of numerous lamps: in the central chamber there is but one lamp. The exterior is very rude.

The second kind of sacred Hindû structures are the temples excavated in solid rocks. Abel Fazal, in the *Ayeen Akbery*, (vol. ii. p. 208,) informs us that in the middle of the mountains in the Soobah of Cashmere, 12,000 recesses were cut out of the rock. Capt. Wilson informs us, that in the extensive branch of the Caucasus, which the Greeks called Parapamésus, on the road between Balkh and Cabul, between India and Persia, are vast numbers of apartments and recesses carved in the rocks, many of which, from their dimensions, must have been temples. There are in this vicinity two colossal statues, a male and a female, the former 80, and the latter 50 ells high, erect, and both adhering to the rock out of which they were cut. The magnificent excavations of *Elephanta*, *Ellora*, and *Salsette*, are described under their respective articles.

A third kind of sacred buildings are temples which consist of extensive courts.

The pagoda of Seringham, near Tritchinopoly, is composed of seven square enclosures one within another, the outermost being four miles in circumference. The walls are 25 feet high, and 4 feet thick, with a gateway in the middle of each side. The stones of which they are built are in some instances of immense size. In the centre is the sanctuary of Vishnu, a chapel 1024 feet square. Many parts are adorned with mystic figures. At Santidas, in Guzerat, Buswara on the Vishnu river, and at Chittambrun on the coast of Coromandel, are fine examples of this kind of pagoda. See the Travels of Tavernier, Sonnerat, and Thevenot. At Chittambrun there is but one court, which is

1332 feet by 936, and the entrance is under a pyramid 120 feet high. (Phil. Trans. vol lxii. p. 354. Orme's Hist. vol. i.)

Some pagodas are built in the form of a cross. The great pagoda of Benares, on the Ganges, has been long the chief seat of braminical learning. Its form is that of a cross, with a cupola in the centre, which terminates in the shape of a pyramid: each extremity of the cross terminates in a tower. Under the cupola, in the inside, is the altar, surrounded by the figures of Hindû idols. The same figure is followed in the pagoda at Malta.

The great temple of Juggernaut, one of the oldest in India, is in the figure of a circle. Juggernaut is said to be only another name for Mahadeo, who is represented by a large bull on the eastern side of the edifice, and his image is on an elevated altar in the centre of the building.

The Hindû temples are generally placed on the banks of the Ganges, Vishnu, or some sacred river, for the convenience of ablution; but when this is not the case, they are accompanied by square tanks or reservoirs, sometimes three or four hundred feet broad. See Crawford's Sketches, and the Oriental Sports.

The most ancient remains of Hindû architecture are doubtlessly the immense excavations, which are apparently as old as the earliest Egyptian temples. Mr. D'Ancarville, in his *Recherches sur l'Origine, l'Esprit, et les Progrès des Arts de la Grèce*, thinks them anterior to the period of 2000 A. C. The columns found in these caverns are rudely formed, but are in many instances more tasteful than those of Egypt. Their capitals generally represent round cushions, pressed down by the superincumbent weight. Colonel Call much admires the elegance of some of the pillars. "I think," he observes, "the carving on some of the pagodas and choultries, as well as the grandeur of the work, exceed any thing of the present day, not only for the delicacy of the chisel, but the expense of construction, considering, in many instances, to what distances the component parts were carried, and to what height raised." In plate *Athenian Architecture*, A. II. we have given several specimens of these columns. *Fig. d* and *e* are from Ellora, and *fig f* and *g* from Elephanta. *a*, *b*, and *c*, which are figures of Hindû arches and gateways, are described under the article *Gothic Arthitecture.* A column in an ancient building near Muddumpore, engraved in Daniell's Views, has the elements of a beautiful style. The gradation from the octagular base to the multangular shaft, setting off to the circular upper shaft, is at once elegant and strong, and its capital is bold and characteristic. We have given in the plate (*Hindu Architecture—Column*) a figure of a beautiful column in the ancient temple of Visvisha, at Benares. It is considered by Mr. Hodges, from whose work we have copied the print, as being of the age of Alexander, when some ideas of Grecian architecture may have been carried into India. Its elements are in every respect Indian; its ornaments are purely Greek. Its base, shaft, and capital are all, in shape, situation, and distribution, completely Hindû, with its multangular and mixed circular shaft, its quadrifrontal capital, and trencher-shaped abacus. In its pedestal is found the Grecian honeysuckle in all its purity; the angles of its shaft are adorned with the sacred water-leaves of the Hindû mythology; above these are the Doric flutes; and in the capital are found the leaves of the Greek acanthus.

The following observations on the architecture of Burmah, are extracted from an article by G. H. Hugh, on the customs of the Burmans, in a recent number of the "Friend of India," published at Serampore, in Bengal.

"In the construction of their dwelling-houses, bamboo, of which there are several species, and in great abundance, is the principal, and in many instances the only material used. Holes, two or three feet deep in the earth, receive the posts, which are more or fewer according to the sizes of the houses. Mats, made of split bamboos, form the outside covering, inside partitions, and sometimes the floor. But, commonly, the latter is made by splitting the material into quarters, laying them down in a series, and tying them to the transverse poles with split rattans. Leaves of the nipah tree, called here *dance*, compose the roof; and a house, not positively uncomfortable, and sufficiently capacious for a small family, is constructed at the moderate expense of thirty or forty rupees. Men of high rank and ample means build their houses in the same form, with posts of teak; the sides, partitions, and floor, are boards of the same wood; and the roof is made either of leaves or of flat tiles. These tiles are burnt like bricks, each about eight inches long, five broad, and nearly one thick, jutting over at the head about an inch, by which they retain their positions upon the rafters. They are laid double, the lower edges of one series projecting over, and lying upon, the heads of the next lower series; thus forming a defence from wind and rain, and presenting a good degree of security from exterior fires. The monasteries are built in the same manner, having two or three roofs elevated one above another, and in many instances, their cornices, angles, and eaves ornamented with carved work of flowers, figures of elephants, of priests, and of other forms which have no existence but in the superstition of the people. The posts of the houses and monasteries, being inserted from two to four or five feet in the ground, are subject to the depredations of white ants, and to rapid decay. The old palace at Amarapoora is built of teak; the roofs piled upon each other to a great height, and, diminishing in size as they ascend, present the appearance of a lofty spire. The exterior and interior parts are covered with gold leaf, and the whole exhibits a resplendent object to the beholder. His present majesty, who ascended the throne of his grandfather about June, 1819, has since built a new palace at Ava, a few miles below the former capital, of which he took possession about March, 1824. The pagodas are solid masses of masonry, varying in height, of a conical form, covered with plaster composed of sand and lime, and many of them with gold leaf. The large paguda, situated about a mile and a half to the NW of Rangoon, and called *Shiva-dagon Parah*, is a splendid and magnificent monument of heathen superstition and idolatry. According to its history, the foundation was laid soon after the supposed anihilation of Gautama. If this be true, it must have existed for a period of about 2,302 years. Since its erection, its size has been increased by successive additions."

The following account of the temples of Arracan, is from the diary of Dr. Tytler. "The *Baboo Deeong* is one of the most remarkable hills included within the boundaries of this extraordinary city. It is situated in a direction nearly due west from the entrance where the army gained admission, subsequently to the escalade which was so gallantly executed by the troops under the command of Brigadier Richards; and is surrounded by four pagodas, dedicated to the worship of Gaudma, Salamoonee, Simoonee, Maha-moonee, or Buddha. Leading to these edifices are several flights of steps, ascending the eastern face of the hill, which are ornamented with colossal figures of deformed giants, composed of brick-work, and plastered with chunam, of an uncouth shape, brandishing clubs in their hands; and what is extremely remarkable, figures of the Egyptian sphynx present themselves close to the temples, and these are so constructed, as to exhibit an acute triangle; two lions' bodies being conjoined to a single female head, placed at the sharp angle of the building. The Baboo Deeong hill is about 100 feet in height, and is composed of strata of schistus; it is completely surrounded with water, even when the tide is ebb. Surrounding the outer wall of one of the principal and most ancient of the Arracan temples, is observed amongst the weeds and jungle, which in many places obscure those interesting relics, a series of very surprising mutilated sculptures, placed in interstices, resembling embrasures, constructed in the ruined wall enclosing the court of the temple. Upon one of those stones is sculptured the Tauric man, or Bucephalus Siva, the Mithra of the Persians, or, in other words, the Sun in Taurus. Another distinctly exhibits the sphynx, consisting of the bust of a woman attached to the body and feet of a lion, or the solar luminary having passed Leo and entered Virgo. The dragon's head and tail, shewed in the headless column of an immense snake's body, are conspicuous upon another stone in the series."—*Asiatic Journal*, April, 1826, p. 512.

"In point of magnitude," says a writer in *The Scotsman in the East*, "the monuments of Arracan are unequalled by any hitherto explored by me, and in some particulars differ essentially from the remains of former magnificence I have examined, either on the continent of India, or on the islands of the Eastern Archipelago. Similar to those of Java, they consist of *octagonal* temples, surrounded with bell-shaped fanes, but, unlike them, are less decorated with sculpture, and are distinguished by stupendous arches, vaults, and arched galleries, which, I had thought, existed only in the imagination of poets and novelists. There exists here the ruins of nearly three edifices, which consist of circular galleries, arches, and vaults, built of brick and stone, strong, cemented with mortar, and of the most massy construction. These subterraneous passages, for they consist of excavations in rocky masses of the hills, contain not fewer, probably, than *ten thousand images* of Buddha, varying in size from not less than fifteen or twenty feet high, to an inch. Many of them are decapitated, which I attribute to the Mussulmans, in their erruptions into this province, as I have discovered a portion of an Arabic inscription near one of the entrances of the principal temple."

On the architecture of Siam, the following observations are from the public accounts of the mission from the Governor-General to the court of Bankok, in 1821, and a description of the public buildings of that city.

"The palaces are buildings of inconsiderable size, in the Chinese style, covered with a diminishing series of three or four tiled roofs, sometimes terminated by a small spire; they are more remarkable for singularity than beauty. The palace of the king is covered with tin tiles. Many of the temples cover a large extent of ground: they are placed in the most elevated and best situations, surrounded with brick walls, or bamboo hedges, and the enclosure contains numerous rows of buildings, disposed in straight lines. They consist of one spacious and in general lofty hall, with narrow but numerous doors and windows. Both the exterior and interior are studded over with a profusion of minute and singular ornaments, of the most varied description. It is on the ends, and not on the sides of the exterior of the building, that the greatest care has been bestowed in the disposition of the ornaments. A profusion of guilding, bits of looking-glass, China, basins of various colours, stuck into the plaster, are amongst the most common materials. The floor of the temple is elevated several feet above the ground, and generally boarded or paved, and covered with coarse mats. The wildest stories of Hindoo theology figure on the walls."—"The arrangements observed in the *Waal-thay-champoun*, may be given as an instance of what occurs in the rest. This consists of a number of temples, *pra-cha-dis*, and buildings allotted for the accommodation of priests, enclosed in an ample square, rather more than a quarter of a mile on each side. The principal temples are further surrounded by a piazza, open only towards the temple, and about twelve or fifteen feet in breadth, and well paved. Against the back wall, a stone platform of masonry extends round the temple, on which are placed gilded figures of Buddha, for the most part considerably larger that the human size." "The *pra-cha-di*, called by the Buddhists of Ceylon *dagoba*, is a solid building of masonry, without aperture or inlet of any sort, however large it may be. It is generally built in the neighbourhood of some temple, but is not itself an object or a place of worship, being always distinct from the temple itself. It would appear to have been sepulchral, and destined to commemorate either the death of Buddha, or his translation into heaven. Even at the present time, these ornamental buildings are thought to contain some relic of Buddha. This one (i. e. that of the Wāāl-thay-champoun) in particular makes a light and handsome appearance: the lower part consists of a series of dodecahedral terraces, diminishing gradually to nearly one half of the whole height, where they are succeeded by a handsome spire, fluted longitudinally, and ornamented with numerous circular mouldings. The minor ornaments are numerous, and towards the summit there is a small globe of glass. The total height would appear to be about 250 feet from the ground. Minor edifices of this sort are common in every temple. They are in general raised upon a base of twelve sides, but sometimes of eighteen." Mr. Finlayson describes a temple which they visited at a short distance from the hall of audience,—a pyramidal structure, its point terminating in a slender spire about 200 feet high. The interior is a lofty chamber, nearly 50 feet square, paved with stones. Sir Thomas Raffles observes, that both in their character, as a sepulchral shrine, and in their form, the pyramid and the dagoba, or pra-cho-di, seem to coincide. At Bankok, Mr. Finlayson observed, for the first time, obscene paintings in a temple dedicated to Buddha. See *Capital*.

Hinges are the iron or brass ligaments affixed to folding-doors, shutters, and parts of buildings revolving on an axis. The most ancient hinges of Egypt were of wood, rolling in a stone box. The hinges of the Greeks and Romans were pins of wood or metal fixed in the middle of the top and bottom of the door or in the threshold, so that the door might open either inwardly or outwardly. Hinges are of many sorts, as butts, rising hinges, new hinges, casement hinges, casting hinges, chest hinges, coach hinges, desk hinges, dovetail hinges, esses, folding hinges, side hinges with squares, garnets, weighty sides, side hinges with rising joints, screw hinges, scuttle hinges, shutter hinges, trunk hinges, of various descriptions, hook-and-eye hinges, and centre-pin-hinges.

The fixing of plain hinges to folding-doors is a common and apparently easy operation, but in some instances great delicacy and art is required. Sometimes, as in the rule joints, it is necessary to conceal the hinge, others intended to allow a door to fall back, are made to project beyond the surface, as in pulpit-doors; these require to be strongly fixed, or they will soon be out of order. The hinge-joint, in which the hinge is entirely concealed, forms the most difficult part of hinging. In *Pl.* P. 3, *fig.* 1, a representation is given of the mode of hanging a window-shutter, or a door of a similar construction, in which the hinge is to be concealed. A, bead on the inside of the sash-frame; B, inside lining of the frame; C, the hanging style of the shutter: *a*, the intersection of the face of the shutter, with that of the inside lining of the same frame; *a*, *k*, the face of the inside lining. Let *a a* bisect the angle *p a k*, the centre *c* being in the line *a a*, the knuckle of the hinge must be fixed at a certain distance from the face of the shutter *p a*; draw the line *d d* to intersect *a a* at right angles; the line *d c* will then be found to be that in which one side of the hinge is to be fixed. That the shutter as it opens may clear the jamb, describe from *c* as a centre, with the radius *c a*, the arc *a i*, which will be the required joint. The strap part of the hinge, on the piece to which the shutter is fastened, may in this case be longer than that on the shutter.

When it is required that the bead of the door jambs and styles shall correspond exactly with the knuckle of the hinge, as the door or shutter opens at right angles with them, let the edge of the style bear a bead exactly the size of the knuckle of the hinge, and be rabetted backwards to the depth of half the thickness of the bead, as shown at 3. The part adapted to receive 3, is shown at No. 4. and 2 represents a common butt-hinge, properly adapted and fixed to the shutter or door. Some little space is left between the sides of the hinge, to allow for the thickness of two or more coats of paint.

Hips, pieces of timber at the corners of roofs. They are much longer than rafters, on account of their slanting position; they are placed not with a right or square, but an oblique angle, and of consequence cannot be square at an angle, (as rafters are at all,) but level at every one of them; and as rafters have four planes, hips have commonly five. By some workmen they are called *corners*, or *principal rafters*, or *sleepers*. But *sleepers* are distinguished as lying in the valleys, and join at top with the hips, and those plane surfaces which make the back of the hip, are the under sides of the sleepers. The backs of a hip are those superficies, or planes, on the outside, which, in length and breadth, lie parallel with the superficies of the adjoining sides, or, in some Italian roofs, with the corner and sides. See *Angle-rafter*, and *Carpentry*.

Hip-moulds, a term used by some workmen for the back of the hip; others mean by this term a form or pattern by which the hip is set out.

Hip-roof. When a roof of a building is formed by equally inclined planes rising from each side, it is called a *hipped-roof*, and the ridges rising from the angles of the wall are called *hips*.

Hip, or Corner Tiles, are those used at the hips of roofs; they are ten inches long, and of a convenient breadth and thickness; they are bent on a mould before burning, and have a somewhat triangular shape, with a hole for a nail at their narrow end, which is laid uppermost.

Hippodrome, (ιπποϛ, *a horse*, and δρομοϛ, *a course*,) a place appropriated by the ancients to equestrian exercises: that of Olympia was one of the most celebrated amongst the Greeks; its length was four stadia, and its breadth one. Another hippodrome is described by Pausanias at Elis. There were two hyppodromes at Constantinople, which are described by Banduri, in his *Imperium Orientale*. One of them is now called the *Atmeidan*. See *Constantinople*.

Hoarding is the timber enclosure about a building, when it is erecting or repairing.

Hood-mould, see *Drip*.

Hook-pins, the same as *Draw-bore-pins*, which see.

Holland-house, as well as the Marquis of Salisbury's mansion, are among the best specimens of the style of Queen Elizabeth's time, and of James I.—the apartments large, galleries disproportionably long, the cornices heavy, and the ceilings formed into compartments of great depth.

Hollow, a concave moulding, about a fourth of a circle, by some called a casement, by others an abacus.

Hollow Newel, a term of an opposite meaning to solid newel, with the ends of the steps built into it; in the hollow newel, the ends of the steps are unsupported.

Hollow Quoins, are the piers of stone or bricks made behind lock gates of canals: sometimes they are of wood.

Hollow Tower, in fortification, a rounding of the remainders of two brisures to join the curtain to the crillon, where the small shot are played.

Holy Island, a place famous for its antiquities: see *Norman Architecture*.

Holy-rood House, the only royal habitation remaining entire in Scotland, is an ancient and remarkable building: the inside is a quadrangle of 230 feet, surrounded by piazzas. The west front consists of two double towers, joined by a beautiful low building, adorned above with a double balustrade. The gate-way in the middle is decorated with double stone columns, supporting a cupola, representing an imperial crown. On the right hand is the great staircase leading to the council chambers and royal apartments. These are large and spacious. The gallery is on the left hand, and measures 150 feet by 27: it is adorned by portraits of all the Scottish kings, from Fergus 1st, to the 7th James. The front of this palace is two stories high; the roof flat. At each end are projections ornamented with circular towers at each angle; here the building is much higher, and the rest of the palace is three stories high. Towers on the north-west were built by James the 5th, for his own residence, and his name appears in a niche. At the time of the restoration, this palace was re-edified by Sir William Bruce, archiect, executed by Robert Mylne, mason.

Home-stall, a mansion-house, or seat in the country.

Horizontal Cornice, is the level part of the cornice of a pediment, under the two inclined cornices.

Horn, a name sometimes given to the Ionic volute.

Horologium, (Gr.) a common term among the ancients for any instrument or machine for measuring the hours. There were anciently two principal kinds; those which measured the time by drops of water in glasses, to which was given the name of *Clepsydræ*, and those in which the place of water was supplied by sand, which had the name of *Clepsammia*. See *Andronicus Cyrrhestes*.

Hospitalia, (Lat.) the doorways in the scene of a theatre amongst the ancients, on the right and left of the valvæ regiæ, or principal doorway. Also, the name given to that part of a house which contained the rooms allotted to strangers.

Hospital, (Lat. *hôpital*, Fr.) a building endowed by public or private charity, for the reception and treatment of invalids: the name is also applied to any charitable institution. In the work of M. Durand, *(Parallèle des Edifices de tout Genre)* we have a collection of plans of different hospitals. The magnificent hospital at Milan has never been entirely finished, but the grandeur of its court-yard, and the surrounding porticoes, and many of its ornaments, which are executed in hard clay, render it a very interesting building. The hospital of Geneva, and that of the Incurables at Paris, partake of the same character. The finest buildings of this kind in England, and which may be considered the most noble in Europe, are those of Greenwich and Plymouth. Hospitals for old soldiers are, in their plan and purpose, the same as the *meritoria* of the Romans.

Hôtel, (Fr.) a large inn, or place of public entertainment.

Hot-house, a building erected for the purpose of raising such exotic plants, as from their extreme tenderness are not able to bear the effects of cold in our variable climate. Hot-houses originally signified bagnios, from the hot-baths there used. Those for orange-trees are said to have been first used, as a mark of royal magnificence, early in the 17th century. Otto de Munchhausen built the first hot-house for pines, about the commencement of the 18th century. The purpose of these erections being to receive as much benefit as possible from the genial warmth of the sun, assisted by subterraneous stoves and flues, the chief object to pursue, will be a proper aspect of the slanting roof, covered with glass, (which is usually made moveable, to admit air occasionally,) and the best construction of the stove and flues. Among the numerous modern improvements, the introduction of steam in preference to warm dry air, or the warm air mixed occasionally with steam, and the air introduced warmed by steam-pipes, has been represented as beneficial; but conceiving the admission of air at the upper part of the building as a great imperfection in these buildings, Dr. Anderson procured a patent for an improved mode of constructing hot-houses, with a glass roof perfectly flat, and another above it, also of glass, but slanting in the usual form. The lower glass framing is made air-tight, to prevent any communication with the common atmosphere, but by the upper roof. A contrivance for occasional communication with the lower apartment, is, however, made by the insertion of a pipe extending through it nearly to the ground. By this construction, as soon as the air in the lower room is rarefied by heat, it ascends, and forces the cold air from the upper story through passages left for that purpose; and when the influence of the sun is withdrawn in the evening, the air in the upper reservoir cooling, becomes heavier, and the current through the tube is reversed, by which the warmer air is made to descend into the lower apartment before the cold can reach it. See *Stove.*

HOUSE, (*hus*, Sax. *huys*, Dutch) a human habitation; a building in which a family resides. Among the Jews, Greeks, and Romans, houses were flat on the top, for walking upon; and had usually stairs on the outside, by which they might ascend and descend. Each house enclosed a quadrangular area or court; which being open to the sky, gave light to it. This was the place where company was received, and for that purpose it was strewed with mats or carpets, for their better accommodation; it was paved with marble, or other materials, according to the owner's ability, and provided with an umbrella of vellum, for a shelter from inclement weather. This part of their houses, called by the Romans *impluvium*, or *cavædium*, was provided with channels to carry of the water into the common sewers. The level roof was covered with a strong plaster by way of terrace. Hither, especially among the Jews, it was customary to retire for meditation, private converse, devotion, or the enjoyment of the evening breeze. See Acts x. 9.

In *plate* P. 3, is given the plan of a Roman house, according to Vitruvius. The vestibulum led into the atrium, a great court surrounded by porticoes, (see *Atrium;*) on the right and left of the atrium were the alæ or wings, within which were sometimes the cellæ familiaricæ, or apartments for domestic purposes. In the atrium, according to Servius (in Virg. Æn. i. 726, and iii. 353,) was also the culina or kitchen. The tablinum was entered from the atrium, which was succeeded by the cavædium; "The exedra and bibliotheca," observes Mr. Wilkins, whom we have followed, "are represented in the plan under the porticoes of the cavædium; because, although Vitruvius does not inform us in what division of the house they were placed, he mentions the cavædium amongst the parts which the clients and friends of the proprietor were at liberty to enter uninvited: whence it is probable that these, being public apartments, were situated in this court." The triclinia, or common eating rooms, are placed in the porticoes of the peristyle. There were also grand banqueting rooms for public occasions, called *œci*, one kind of which was termed Corinthian, another Tetrastyle, a third Egyptian, and a fourth Cyzicene, which is the kind introduced in the plan. In plans of Roman houses commonly given, all the kinds of œci are introduced. But it seems more probable that there was but one large banqueting room in the generality of houses. Vitruvius is altogether silent upon the use of the apartments on the second floor; he mentions stairs, but he does not point out their situation. In our plan, *a* is the vestibulum, *b* the atrium, *c* the tablinum, *d d* the alæ, *e e* cellæ familiaricæ, *f* cavædium, *g'* vernal triclinium, *g''* summer triclinium, *g'''* winter triclinium, *i'* cold bath, *i''* tepid bath, *i'''* warm bath, *k k* cubiculæ, *m* pinacotheca, *n* bibliotheca, *o* peristyle, *q* Cyzicene œcus, *r r* courts of the offices, *s* exedra, *t t* gardens, *u* rooms for embroidery, *v v* sudatories. In the foregoing plan, we have followed Wilkins; in the sketch below it, we have given the plan according to Newton, (Translation of Vitruvius,) where all the œci are introduced. Here *k* is the procœton, *l* the basilica, *p* the servants' rooms, *q* the Egyptian œcus, *r* the Corinthian œcus, *s* the tetrastyle œcus, and *t* the Cyzicene œcus. The other references are the same as in the figure above. The vestibula, the atrium, and the offices, are not introduced, as they are placed in the same situation as by Wilkins.

The Greek house had no atrium, but instead of it the peristyle was approached by a passage called *thyroreum*. On the side of the peristyle opposite the entrance was a kind of vestibule called *pastas*; the apartments on the right and left of which were termed severally *thalamos* and *amphithalamos*, and beyond them were the œci or halls. In the first peristyle were the triclinia in daily use, and the apartments of the domestics; this division of the house was called *gynæconitis*. In the south portico of the greater peristyle, which was termed *andronitis*, were the Cyzicene œcus and pinacothecæ, in the eastern the bibliotheca, in the western the exedra, and in the northern the great œcus or banqueting room. The hospitalia consisted of triclinia and sleeping rooms for strangers, and were on the right and left of the great œcus. There were courts or passages to these apartments called *mesaulæ*. In the plan, (on *plate* P. 3.) *a* is the thyroreum, *b* peristyle of gynæconitis, *c* pastas or vestibule, *d* great œcus, *e* stables, *f f* courts, *g g g* cellæ of the porter, *h h* common triclinia, *i* thalamos, *j* amphithalamos, *k k* square œci, *l l* mesaulæ, *m m* apartments for strangers, *n* vestibule, *o* great peristyle, *p* bibliotheca, *q q* pinacothecæ, *r* Cyzicene œcus, *s* exedra.

A country house is commonly for the occasional residence of rich citizens, to enjoy the pleasures of the country. Such was the *villa* of the ancient Romans; the *quinta* of Spain and Portugal, called in Provence *cassine*; in some other parts of France, *closerie*; and in Italy *vigna*. The citizens of Paris have also their *maisons de bouteilles*, or *bottle-houses*, in which they regale their friends.

In a country house it is particularly necessary to have wood and water near, and spring water of the best quality. It is far better to have a house defended by trees than hills; for trees yield a cooling, refreshing, and sweet shade during the heat of summer, and in winter are a protection from cold winds and tempests. Hills, as they may be situated, defend only from some certain winds, and if on the north side of the house, as they defend from the cold air in winter, they also deprive of cool refreshing breezes in summer; if the hills are on the south side, they are yet more inconvenient. A situation too low precludes the convenience of cellars, and is seldom dry and healthy. If this inconvenience cannot be avoided, let the first floor be raised above the ground; and by the appropriation of the ground-floor to the purpose of cellaring, the house will be rendered dry, and pleasant, and healthy. Houses built too high, and neither defended by hills nor trees, require more materials and stouter walls, and are not so comfortable to the residents, as those less elevated and less expensive, yet not less beautiful. In houses of not above two stories with the ground-room, and not exceeding twenty feet to the wall-plate, and upon a good foundation, the length of two bricks, or eighteen inches, for the heading course, will be sufficient for the ground-work of any common structure, and six or seven courses above the earth to a water-table, where the thickness of the wall is abated, or taken in on either side the thickness of a brick, namely, two inches and a quarter. For large and high houses, of three, or four, or five stories, with garrets, the walls, from the foundation to the first water-table, must be three heading courses of bricks, or twenty-eight inches, at least; and at every story, a water-table, or taking in, on the inside, for the summers, girders, and joists to rest upon, laid into the middle, or one quarter of the wall at least, for the better bond. But as for the innermost or partition-wall, a half-brick will be sufficiently thick; and for the upper story walls, nine inches, or a brick length, will suffice. The parts, proportions, &c. of houses in London are regulated by statute. See *Building* and *Villa*.

House, portable, described in the Register of Arts, is a very ingenious and simple contrivance, by a shoemaker who resided in it. Each side is made up of three equal parts, each part reaching from the ground to the roof; two iron rods, furnished with nuts and screws, run across each side, and pass edgeways through the two contiguous sides, by which the four sides are held firmly together. Joists are bolted to each of the sides, by which the floors are supported. Each side of the roof is in one part, all the four sides of which are bolted together at the angles. None of the parts are larger than two men may easily manage. The whole house, which contains three flats, may be taken down, removed to a considerable distance, and put up again in one day by two men, with the assistance of a horse and cart. The advantages of this plan are self-evident. Many delightful spots might be obtained for the site of a portable house during the summer months, where there is no probability of a fixed residence being built. To the sportsman in particular it would furnish a cheap and most comfortable lodging on the moors.

Housing, the hollow made in one body, to receive the extremity of another.

House-warming. In ancient times new houses were consecrated by fire and sacred rites, and friends and neighbours presented viands for a feast; and the custom of warming newly occupied houses by feasting friends and neighbours, may possibly be a vestige of the ancient ceremonial.

Hovelling, a mode of preventing chimneys from smoking, by carrying up two sides higher than those less liable to receive strong currents of air; or apertures are left on all the sides, so that when the air blows over the top, the smoke may escape below.

Humeri, (Lat.) the angles of a temple formed by the longitudinal and transverse walls of the cella. In the Greek inscription, brought from Athens by Dr. Chandler, the humeri are mentioned, and termed *harmoi*, ἁρμοι.

Hunting Towers. There is a tower of this kind of great antiquity, at Chatsworth, built, as we are informed in the second volume of the Antiquarian's Repertory, for the purpose of giving the ladies of those days an opportunity of enjoying the sport of hunting; and there is also an ancient castle at Tibbermuir, near Perth, in Scotland, bearing this name; it belonged originally to the Ruthven or Gowry family. It was here that an earl of that house imprisoned his king, the sixth James. A daughter of one of the earls of Gowry, in danger of being discovered with her lover, who was not approved by the family, ran to the top of the tower, and took a leap of nine feet four inches over a chasm of sixty feet high; luckily alighting on the battlements of the opposite tower, in which her astonished mother found her in bed, and apologized for her suspicion; on this account the space between these towers received the name of the *Maiden's Leap*.

Hurlers. The name given to a singular erection of large stones, forming a quadrangle, near St. Clare, in Cornwall. By some antiquarians they are believed of Druidical origin; by others, they are supposed to be commemorative of victory, or the monuments of heroes. The country people believe that men engaged in the game of hurling the ball on a Sunday, were for that profanation petrified, forming this assemblage.

Hurries, a term applied in some places to the stages of wood on navigable rivers, harbours, &c. to which the railways are conducted from coalpits.

Hut, (*hutte*, Sax.) a small cottage, built of wood and earth. In countries abounding in woods, the first inhabitants would naturally seek shelter amongst the trees of the forest; next they would weave together the branches over their heads, to make the shelter more complete; and step by step would at length form artificial cabins or huts of turf and the branches of trees. The Colchians, according to Vitruvius, who inhabited a plain on the shores of the Euxine, in a woody country, formed their dwellings by placing at an equal distance trees of a certain length, across which they laid others transversely through their extremities; the space between the trees was filled with loam and small branches, so as to form a kind of wall; four smaller trees, placed over the top, and joining at a point over the middle, formed the roof, which was also covered with loam. The Phrygians, as we learn from the same author, followed a different method: inhabiting a country in which wood was scarce, they made their dwellings on small hills, on the summit of which they dug pits as deep as they thought necessary, and made an outlet at the side. Over the top they placed branches of trees, and covered them with straw, reeds, and earth. Among the Arabians, in the cities of Lohein, Tehama, and Machan, we still observe huts of little better construction, even beside the more durable houses of the rich. The Tünguses, a people of Siberia, who live a wandering life among the woods and on the banks of the rivers, form their huts in the following manner: They place long poles in a circle, so as to meet together in the middle in the form of a cone; at the summit a hole is left, through which the smoke may escape; the entrance is about four feet high. A number of huts have been built on the borders of the South Esk, in Scotland, which have a very picturesque appearance. They are built of a sort of muddy clay, mixed with the roots of aquatic plants, that is dug from the side of the river in suitable sizes and shapes, which are generally those of bricks.

Hydraulic Mortar. See *Aqueduct.*

Hydraulos, (Gr.) a pneumatic engine mentioned by Vitruvius and other ancient authors, the use and form of which are not well known.

Hypæthros, (Gr. from *ὑπο, above*, and *αιθηρ, the air.)* The seventh order of temples mentioned by Vitruvius, which had ten columns on each façade, and was surrounded by a double portico, as in dipteral temples. The cella was without roof, being entirely exposed to the air, but it had generally round it a portico of two ranges of columns, one above the other. Several examples of *hypæthral* temples still remain, but they all differ in some particulars from the description of Vitruvius. The principal are, the great temple at Pæstum, described in the works of Paoli, and Delagardette on the Ruins of Pæstum, *(see Pæstum,)* the temple of Jupiter Olympius at Athens, (see *Athenian Architecture,)* that of Selinus in Sicily, (see *Selinus,)* that of Minerva at Athens, and that of Jupiter Panhellenius at Ægina, (see *Ægina.)* The cella of the *hypæthral* temple was twice as long as wide; and as every *hypæthral* temple had, on account of its length, two entrances, it had also two pronaoi.

Hyberbola, (Gr. from *ὑπερ, over*, and *βαλλω, I throw,)* a section of the cone, made by the cone being cut by a plane which falls within its circular base, being neither parallel to the side of the cone, nor cutting it through its vertex, but which, if continued, would cut the opposite cone. A hyperbola is termed *acute*, when its asymptotes make an acute angle; *ambigenal*, when one of its infinite legs falls within and the other without an angle formed by the asymptotes; *deficient*, when it has only one asymptote, although two hyberbolic legs run out by its side, but in contrary directions; *equilateral*, when its asymptotes are equal.

Hyberbolic Cylindroid, a solid formed by the revolution of the hyperbola about its conjugate axis.

Hyperboloid, or *Hyberbolic Conoid*, a conoid formed by the revolution of the hyperbola about its axis. It bears a proportion to a parabola of the same base and altitude $= t + \frac{2k}{3} . t + k$, t being the transverse axis of the generating hyberbola, and k the altitude of the solid. To find its solidity, we must add to the areas of the two ends four times the area of the middle parallel section t, and multiply the sum by $\frac{1}{6}$ of the axis or height.

Hyperthyrum, (Gr. *ὑπερ above*, *θυρα, a door*,) in ancient buildings the ornament which extends over the aperture of the doorway

Hypocaustum, (Gr. *a stove*,) an arched chamber among the ancients, in which a fire was made to warm the rooms above. The heat was conducted by means of tubes carried through all the rooms. This mode of heating rooms does not appear to have been in use among the Romans before the time of the emperors. Winckelmann has given us a description of a hypocaustum, which was discovered under some chambers among the ruins of Tusculum. Beneath the rooms, he says, were found little cells, about as high as a table, two under each apartment, and without any entrance. Their ceiling was made of large flat bricks, and supported by two pillars, constructed of brick and loam. Through the ceiling ran quadrangular tubes made of loam, the upper extremity of which terminated in the chamber above, whilst the other end descended half way down the little cell. Other tubes were carried in the wall to the rooms on the second story. The extremity of the tube was often decorated with a lion's head made of hard clay. The cells were approached by a corridor two feet wide, and the coals were introduced by a square opening. In baths, the hypocaustum was placed in the middle, and around it were placed the other chambers appertaining to the bath, so that people might pass directly out of one into the other.

Hypogæum, (Gr.) a term applied among the ancients to those parts of a building which were below the level of the ground, and more particularly to the vaults where they deposited the remains of the dead. Montfaucon, in his *Antiquité Expliquée*, tom. v. pl. 3. has given a figure of two *hypogæa*, in the interior of which are seen the niches containing cinerary urns. In the same volume, pl. 5, and pl. 118, he has given the design, plan, and description of two others, one found in the Villa des Cavaliéri, and the other in that of Corsini. The *hypogæa* in later times were often richly ornamented. See the plates to our article *Roman Ornaments.*

Hypomochlion, the fulcrum or prop of a lever, which, when heavy bodies are raised by that instrument, bears all the incumbent weight; it is applied also to the roller placed under pieces of timber or stones, to facilitate their removal.

Hypopodium, (Gr.) a footstool used in the ancient baths, &c.

Hyposcenium, (Gr.) a term applied by Pollux to the wall before the scene which faced the orchestra.

Hypotrachelium, (Gr.) a term given by Vitruvius to the slenderest part of the shaft of a column where it joins the capital. It signifies the part *under* the *neck*.

I.

Jackly, see *Jackly*.

Icehouse, a subterraneous apartment for preserving ice during the summer. The best situation for an icehouse is in a chalky or a loose gravelly soil, on a declivity, where a cavity is dug in the form of an inverted cone, and, when the nature of the soil requires it, accompanied with a drain, which may conduct the waste water into a well. The sides should be of bricks, without mortar, and the doors should be made to shut close, and should have bundles of straw before them, to exclude the air as much as possible. The ice should be placed on a frame, or a cart wheel, covered with straw. The ice should be pressed together in a body as hard as possible

Ichnography, (Gr.) the transverse section of a building, which represents the circumference of the whole edifice, the different rooms and apartments, with the thickness of the walls; the dimensions and situation of the doors, windows, chimneys, the projection of columns, and every thing that could be seen in such a section, if really made in a building.

Icosahedron, (Gr.) a regular body, consisting of twenty triangular pyramids of equal height and bases, their vertexes meeting in the centre of a sphere, which is supposed to circumscribe it. If the linear side be a, the surface will be $5a^2\sqrt{3}$ and the solidity $\frac{5a^3}{6}\sqrt{\frac{7+3\sqrt{5}}{2}}$.

Imbow, to arch over.

Impages, (Lat.) a term used by Vitruvius (lib. iv. c. 6,) and supposed to mean the rails of the door.

Impetus, (Lat.) the span of a building, arch, roof, &c.

Impluvium, (Lat.) the central part of the court, amongst the Romans, which was uncovered, and the breadth of which was never less than a quarter, or more than a third, of that of the *Atrium*. See *Cavædium* and *Atrium*.

Impost, (from *impono*, to *lay on*, Lat.) the layer of stone which crowns a door-post or pier, and which supports an arcade, &c. It generally projects, and is ornamented with mouldings. An *arched impost* is that which crowns the pier of an arcade, and turns in an archivault, or which crowns a circular wall, niche, &c. An *impost* is *mutilated* when its projection is diminished, that it may not exceed that of a pilaster, as at the Fontaine des Innocens at Paris.

In Antis. Temples are said to be *in Antis* when there are two columns between the *antæ* of the lateral walls and the cella: this disposition is observed in the remains of the temple at Myus, of which figures are given in the second volume of the Ionian Antiquities, and in the Architecture Comparée of Mr. Durand. See *Anta*.

Inbond Jambstone, a bondstone laid in the joint of an aperture.

Inch, (*ince*, Sax.) the twelfth part of a foot.

Incertum, (Lat.) a term by which Vitruvius designates a mode of building, which consisted of small rough stones and mortar. Chandler is mistaken in giving the name of *incertum* to walls constructed of hexagonal and pentagonal stones without mortar.

Inclination, (Lat.) the mutual approach of a line to a plane, or of two planes to each other.

Inclined Plane. The inclined plane is one of the mechanical powers, and is not only used to assist in raising ponderous bodies of immense magnitude, to elevations to which they could scarcely be raised by any other way; but also the natural declivities of hills are frequently made to serve the purpose of the quick conveyance of coals, timber, or other articles, to a considerable distance, without the aid of horses. The most remarkable work of this kind is the Slide, or inclined plane, of Alpnach, in Underwalden, in Switzerland. This great and singular erection was completed under the superintendence of Mr. Rupp, in the year 1812, for the conveyance of the timber of the lofty pine-trees from the top of Mount Pilatus into the lake of Lucern. This wood was purchased for £3000, and the expense of the slide was £9000. Its length is eight miles and a quarter, and it rises from the level of its lower extremity 2600 feet. It is in the form of a trough, about five feet broad and four deep, the bottom of which is formed of a triple series of trees, those in the middle being hollowed out, to admit a stream of water conveyed into it to lessen the friction. The declination at the commencement of this work forms an angle of twenty-two and a half degrees. The pines, stripped of their branches, descend by their own gravity when placed on the slide, and proceed rapidly with an accelerated motion, acquiring an astonishing velocity, passing the distance of upwards of eight miles in six minutes; and in rainy weather, with an increase of water, the passage is effected in three minutes. Sometimes a tree springs out of the groove, when, if it goes against a growing tree, it cuts it in two as smooth as if with an axe.

Incombustible. We read in Aulus Gellius, that Sylla endeavoured in vain to burn a wooden tower that was defended by Archelaus, one of the generals of Mithridates, because it was soaked with alum. Gregory of Tours speaks of certain wooden vessels that were made in his time, that withstood the fire as well as those of iron, but he does not tell us by what process they were made incombustible. Attempts have been made to compose a chemical mixture, that would render houses incombustible. In 1756, Hales proposed to cover them with earth, but this is only practicable in rustic habitations. M. Soubeyran, of Montesorgues, in 1759, and M. Didelot, in 1781, made several trials, but without the desired success. Dr. Fochus, of the Academy of Science, Munich, has discovered a composition which renders wood incombustible; it is made of an alkali, mixed with an earth, and is said to be produced by the mixture of lime and clay calcined in a furnace. An equal quantity of argillaceous earth or clay is to be mixed with lime and water, till of the consistence of thin plaster; this is evaporated to dryness, and subjected to the heat of a lime-kiln furnace, and, being afterwards mixed up of a proper consistence, is found to dry as hard, and of as compact an appearance as Portland stone, of which it is a good imitation.

The saturating of timber, or any other combustible substance, with a solution of soda and potash, render them completely fire-proof; and a patent was granted to Mr. Benjamin Cook, of Birmingham, April 16, 1822, for the discovery of this mode of preventing accidents from fire. The mode of effecting this purpose is described in the 44th volume of the Repertory of Arts and Manufactures. Either of the alkalies separately will have the same effect, as also a solution of alum.

Incrustation, (Lat.) any thing, such as mosaic, scagliola, &c. applied with mortar, or with mastic, or with cramps, to incisions that have been made for its reception.

Indefinite, (Lat.) a line, &c. which has but one extreme, which may be produced infinitely in a direction opposite to this extreme.

Indented, (Lat.) toothed together.

Indian Architecture. See *Hindû.*

Indian Rubber, a substance produced from a tree in Cayenne and South America, called the *Syringa* tree. It is most abundant in rainy weather, when it oozes in a milky form from incisions made in the tree, and acquires the consistence, which it has when we get it, merely by exposure to the air. The colour is given to it by exposing it to the smoke of burning vegetables.

Indurating, (Lat.) any thing which hardens another.

Infirmary, a public building for the reception of the sick; in ancient abbeys, an establishment of this denomination was usually provided.

INLAYING. See *Incrustation*, *Mosaic*.

INSTRUMENTS, *Mathematical.* A common case of mathematical instruments contains—(1.) A pair of drawing compasses, with pen, portcrayon for pencil, &c. and dotting leg; (2.) a pair of plain compasses or *dividers;* (3.) a drawing pen; (4.) a plain scale; (5.) a sector; (6.) a protractor, in the form of a semicircle or rectangle; and sometimes, (7.) a pair of bow compasses; (8.) a pair of triangular compasses; (9.) a pair of proportional compasses; and (10.) a parallel rule.

(1.) The best kind of *drawing compasses*, have a cylindrical socket, with a parallel slit on the outer side, into which the end of the foot fits.—(2.) Of *plain compasses*, there are two sorts, common dividers, and *hair* dividers, which are adjusted by a screw.—(3.) The *drawing pen*, has generally a pointer screwed into the upper end.—(4.) The *plain scale*, has the following scales upon it: a line of six inches, a line of fifty parts, and a diagonal scale on one side; and on the other a line of chords marked C, and seven decimal scales of parts, the numbers at the beginning of which shew the number of the small divisions at the beginning which are contained in an inch. The line of fifty parts being equal to six inches, gives the hundredth part of a foot. By the diagonal scale any number may be laid down to the hundredth part of an unit; and at one end on a scale, just twice the size of the other. Thus, if we consider the divisions at 1, 2, 3, &c. as each an inch, foot, mile, or any other measure, the diagonals at the end will give the hundredth parts. For instance, if we wished to lay down 3,65 inches, we must place the foot of the compass on the fifth parallel under 3, and extend the other foot to the 6th diagonal on the same parallel, and it will give the exact length; and if it were required to set down 6,28 yards, we should proceed in the same manner, by placing one foot on the 8th parallel under 6, and stretching the other to the second diagonal on that parallel. If we considered each of the divisions as 10 feet, &c. then the first measure would represent 36,5, and the second 62,8, and if we reckoned them as 100, they would be respectively 365 and 628. The line of chords is of great use in laying off or measuring angles. If we wish to have a line at a given angle, suppose 23 degrees, to a given line which we may call A C, from a given point as A, we have only to set one point of the compasses at the beginning of the line of chords, and extend it to 60, then with this radius describe an arc from the given point on the given line, and take 23 degrees from the chords in the compass, and measure it off from the given line on the arc to B, and from the given point draw a line through B, and it will give the required angle. If, on the other hand, it be required to measure a given angle, suppose ACB to be the angle, in *fig.* 12, plate M 1, with the same chord of 60, from the point A describe an arc as from B to A, take the length from A to B in the compass, apply it to the scale, and it will give the degree contained in the angle. The seven decimal lines are called *plotting scales;* and as their divisions of an unit into ten parts being on scales differing in a ratio of 4 to 1, the scale of a map, place, &c. may be varied in seven different drawings comformable to the same ratio.

—(5.) The lines generally laid down upon the *sector*, are: a line of equal parts, marked L; a line of secants, marked S or *se;* a line of chords to 60 degrees, marked C; a line of polygons, marked P O L; on the other side a line of sines to 90 degrees, marked S; two lines of tangents, one to 45 degrees, the other from 45 to 75 or upwards, marked T or *ta;* along the side, when quite open, Gunter's line of artificial numbers, marked N; a line of artificial sines, S; a line of artificial tangents, T; a line of 12 inches; and a line of the foot divided into 100 parts. The following examples will illustrate the use of each line:—*Line of lines*, L. Three numbers, 4, 6, and 12, being given to find a fourth proportional; take 12 parts in the compass from the beginning of the line L, and, opening the sector, apply it across from 4 to 4; then, with the instrument open to the same angle, take in the compasses the distance from 6 to 6, and by applying one foot on the line from the beginning, the other will reach 18, for the answer. *Line of chords*, C. In *fig*. 12, *plate* M, 1. suppose it required to draw an angle DCB = 35°, with any convenient opening, take the extent from 60 to 60, and with it, as a radius, from the point C describe the arc BD, and with the same opening of the sector, take the extent from 35 to 35, and set it on the arc BD to D, and by drawing the line CD, the angle will be completed. *Line of sines*, S. In the triangle $a\,b\,c$, *fig*. X, (*Pl. Acropolis, Tiryns,*) if $a\,b = 230$, and the angle $a\,b\,c = 36° 30'$ be given, to find the side $a\,c$; take the distance 230 on the line of sines, and a the angle at c is 53° 30′, set it off from 53° 30′ to 53° 30′ in the line of sines; take the distance from 36° 30′ to 36° 30′, which will measure on the line of sines 170,19, the length of $a\,c$. *Lines of tangents*, TT. Let $a\,c$, the tangent of the angle b be required, when $a\,c = 230$, and the angle b 36° 30′, take 230 from the line of sines, set it off from 45° to 45° on the line of tangents, then measure from 36° 30′ to 36° 30′ on the tangents, apply it to the line of sines, and it will give 170,19, the tangent $a\,c$. *Lines of secants*, S or *sec.*—When the base $a\,b$, and the angles $a\,c\,b$, $a\,b\,c$, are given to find $b\,c$, the secant of $a\,b\,c$, take 230 on the line of sines; make it a parallel distance at the radius or beginning of the lines of secants, take the secant of 60° 30′, measure it on the line of sines, it will be 287,12, the length required. In the solution of spherical triangles, the lines of *sines* and *tangents* are used conjointly; thus in the spherical triangle $e\,f\,g$ (*fig*. 1, *Pl. Athenian Architecture*, A.9) right-angled at e. The side e = 36° 15′, and the adjacent angle f = 42° 34′ being given, it is required to find the side $e\,g$; measure the sine of 36° 15′ from 90 to 90, the parallel tangent of 42° 34′ will give the lateral tangent of 28° 30′ $e\,g$. *Line of polygons*, POL.—Take any parallel distance between 6 and 6 as the radius of a circle, then the distance between 4 and 4 will be the length of the sides of a square inscribed in the circle, from 5 to 5 of a pentagon, from 12 to 12 of a regular figure of 12 sides, &c. *The artificial lines of numbers, sines*, and *tangents*, commonly called *Gunter's lines*, from their inventor, are applicable to the same purposes as the sectorial lines. Thus, if it be required to find a fourth proportional to 3, 9, and 10, take the extent from 3 to 9 with the compasses on the line of numbers N, with this measure, place one foot in 10, the other will fall on 30, the answer. In *fig*. X, *Pl Acropolis*, if the two angles *b* and *c*, and the side *a b* be given, to find *a c*, take the extent from 53° 30′ to 36° 30′ on the artificial line of sines S, and put one foot on 230 in the line of numbers, the other will fall on 170,19. To find *a c*, the tangent of *b*, measure from 45′ to 36° 30′ in the artificial line of tangents T, and it will reach from 230 to 170,19, on the line of numbers. We may solve the example of the spherical triangle, by taking the extent from 90° to 36° 15′ in the line of sines, and it will reach from 42° 34′ to 28° 30′ in the line of tangents. —(6.) The use of the *protractor*, is to lay down or measure an angle, for which purpose it has 180 degrees marked round the outer edge; when of metal, it is made in the form of a semicircle; but when made of ivory, it is made rectangular, and is commonly more exact. —(7.) *Bow compasses*, are used for drawing small circles with great exactness.—(8.) *Triangular compasses*, have three legs, two moving the same as common compasses, and the third fitted into a socket at the head, so as to move in any direction; they are used to measure angles or triangles, and are very useful in drawing, to ascertain, from two fixed points, the situation of a third. —(9.) *Proportional compasses*, are used in graduating the radii of spirals, in dividing circles or straight lines into equal parts, &c. The common form is that of a cross, with a parallel slit down the middle of each part, and a centre piece moveable round a pin, and fastened by a nut and screw.—(10.) Of *parallel rules*, there are two kinds, the common kind, and the rolling parallel rule, the latter of which is on many accounts preferable.—(11) *Elliptic compasses*, consist of a beam *a b*, *Pl.* C. 67, *fig.* 4, about a foot long, with three cursors or sliders, to one of which may be screwed a point or pencil; to the bottom of the other two are riveted two sliding dove-tails, adjusted in grooves made in the cross-branches of the instrument. These having a motion every way, by turning about the long branch, go backwards and forwards, along the cross: so that when the beam has gone half way about, one of them will have moved the whole length of one of the branches; and when it has got quite round, the same dove-tail has got back the length of the branch. The distance between the two sliding dove-tails, is the distance between the two foci of the ellipsis, and by changing that distance, the ellipsis may be changed to any dimension.—(12) *German compasses*, have their legs a little curved outward, so that their points only meet.—(13) *Draught compasses*, are provided with several moveable points, for the purpose of drawing fine lines in architecture

INSULAR COLUMN, is a column standing by itself.

INTAGLIO, (Ital.) any thing with figures in relief on it.

INTAVOLATA, the same as *Cymatium*.

INTERCEPTED AXIS, a term in conic sections; it is that part of the diameter of a curve line comprehended between the vertex and the ordinate; it is also called *abscissa* and *apscis*, or *apsis*, and forms an arch of a peculiar kind, appropriated to the canopy of a kingly or an ecclesiastical throne, and to vaults in churches. See *Apsis*.

INTERCOLUMNIATION, (Latin) the space between two columns, measured from the place where they are of an equal thickness. As the diameters of the shaft of a column is not the same in all its height, the lower part of the shaft, immediately above the base, has been fixed upon as the measure of columns and intercolumniations. In the remains of Egyptian architecture, the intercolumniation is from a foot and a half to three feet, and rarely more. Vitruvius enumerates five different properties of intercolumniation, designated by the names of *Pycnostylos*, *Systylos*, *Diastylos*, *Aræostylos*, and *Eustylos*, (see these words.) The two first were considered as very inconvenient, as they did not allow room for two persons to enter the temple abreast. The diastyle and the aræostyle, from their too great width, seemed to weaken and endanger the architrave, and on this account wooden architraves were used in the latter. The eustyle was preferred both for the elegance of its proportion, and because it offered a convenient passage between the columns, without diminishing the solidity of the architrave. It is probable, that in the Doric order the diastyle and systyle intercolumniations were exclusively or principally used, and that the other three were little used, on account of the difficulties they caused in the distribution of the triglyphs and metopes. In the Ionic order, all the different modes might be used. The aræostyle seems to have been used principally in the Tuscan. It appears, however, that the ancients did not always observe the rules laid down by Vitruvius for the disposition of the intercolumniations; at least the dispositions of the intercolumniations in the remains of ancient temples rarely agree with those which are given by that author. We find the intercolumniations unequal, and disposed so that that in the middle of the façade of a portico is larger than those on each side, which often diminish some inches in each intercolumniation, the two last being the narrowest. Such is their disposition in the temple at Segesta, in the temple of Concord at Agrigentum, and in the great temple at Pæstum, of which figures are given in the works of M. M. Houel and Delagardette. In this latter temple, however, this disposition exists only in the two principal façades; at the sides, on the contrary, the intercolumniations are equal, except the two last towards the angles, which were always made narrower than the others, on account of the triglyphs of the corners. Nevertheless, there are temples more ancient, and others belonging to the same epoch as these, on every side of which the columniations are all equal, except only those at the corners. In the temple at Corinth, the small temple at Pæstum, and the great temple at Selinus, the intercolumniations are equal to the inferior diameters of the columns, and in that of Thoricus, of which a figure is given by Le Roy, is a little more. Towards the time of Pericles, this distribution began to be constantly observed. The intercolumniations of the temple of Theseus, and the Parthenon at Athens, which are given in Stuart, and those of the temple of Jupiter Nemeus, near Argos, given in the Ionian antiquities, are not quite equal to an inferior diameter and a half of the columns. Those of the temple of Jupiter Panhellenius, in the isle of Ægina, and of the temple of Minerva Sunias, on the promontory of Sunium, also given in the Ionian Antiquities, are a little larger. In many of these temples, which appear all to be of the Doric order, the columns seem to approach each other too near, and the intercolumniations to be too narrow to allow a free passage: however, as the inferior diameter of the columns, by which the width of the intercolumniations was determined, was very considerable, they were sufficiently large. But when the shaft of the columns were formed less conical, and consequently the inferior diameter was diminished, it became necessary to make the intercolumniation more than a diameter. This is observed in some of the Doric temples just mentioned, and always in those of the Ionic order. The intercolumniation of the Ionic temple of the Ilissus is a little more than two inferior diameters of a column; and it is nearly two diameters in the temple of Apollo Didymæus, near Miletus. The temple of Bacchus at Teos exhibits the eustyle which was invented by Hermogenes, who built it. But after it had become well known, this mode was not always used. In the Erechtheium, the intercolumniation of the portico is equal to two inferior diameters, and that of the portico of Minerva Polias is a little more than three; that of the temple of Fortuna Virilis, and that of the Corinthian portico of the Panthenon, at Rome, are a little more than two diameters. The intercolumniation of the temple of Antoninus and Faustina, that of Jupiter Stator, and of the Basilica of Antoninus, at Rome, as given by Desgodez, are a little more than three modules. The peculiar design of some buildings, as the Doric portico and the Propylea, at Athens, one leading to the market, and the other to the citadel, and which consequently ought to have a wide passage, required the intercolumniation of the middle to be greater than that of the sides. Vitruvius directs, that, in temples of the Ionic order, the intercolumniation of the middle of the principal façades ought to be equal to three, and the others only to two and a quarter inferior diameters; that in the Doric diastyle, there ought to be three triglyphs above the intercolumniation of the middle, and only two on the others; and that in the systyle, where one triglyph was commonly placed between each intercolumniation, there ought to be two above that in the middle.

INTERDENTIL, the space between dentils.

INTERDUCES, see *Inter-ties*.

INTERFENESTRATION, the space between windows.

INTERJOIST, the space between joists.

INTERMODILLION, the space between two modillions.

INTERPENSIVÆ, (Lat.) timbers in the roof of the cavædium, extending in a diagonal direction from the angles of the court to the junction of the beams of the roofs, and used to carry colliquiæ or gutters.

INTERPILASTER, is the interval between two pilasters, which should always be regulated by the principles of intercolumniation.

INTERQUARTER, the space between two quarters.

INTER-TIES, are short pieces of timber used in roofing, to bind upright posts together, in roof partitions, in lath and plaster work, and in walls with timber framework.

INTRADOS, (Italian) the under curved surface or soffit of an arch.

INTRITA, a kind of clay, clammy like pitch, used in old time for mortar, and in lamps instead of oil.

INVALIDES, HÔTEL DES, an hospital at Paris, begun in 1671, after the plan and designs of

Liberal Bruant, under the reign of Louis XIV. for the reception of the veterans who had fought in the various battles during his reign, and which bears some resemblance in its general form to the Prætorian camp of the Romans.

INVERTED ARCHES, such as have their intrados below the centre or axis. Inverted arches are of great utility in giving stability to buildings, in all cases where the wall is higher on each side than the cord of the arch.

IONA, one of the islands called the Hebrides; its name in the original language signifies the "Island of Waves." This little island is celebrated for its remarkable antiquities; and in history for having been "once the luminary of the Caledonian regions, whence savage clans and roving barbarians derived the benefits of knowledge, and the blessings of religion." It has only one town, near which is the Bay of Martyrs, so named on account of those who were slain there by the Danes. Beyond the town are the ruins of the nunnery founded by St. Columba; the church is 58 feet by 20, and the east roof is entire. On the floor is the tomb of the last prioress, with her figure praying to the Virgin Mary. From hence a broad pavement leads to the cathedral, and on the way is Maclean's Cross, which of 360 is the only one that survived the Reformation. A large enclosure, called *Relig Ouran*, is the burying place of Oran, where the kings of Scotland, Ireland, and the Isles, and their descendants, were buried, in three different chapels. One of these, containing 48 Scottish monarchs, from Fergus II. to Macbeth, is inscribed, *Tumulus Regum Scotiæ;* the next, *Tumulus Regum Hiberniæ*, containing four Irish monarchs; and the third, *Tumulus Regum Norwegiæ*, containing eight Norwegian viceroys of the Hebrides. Above 300 inscriptions were collected here by Mr. Sacheverel, in 1688, and given to the Earl of Argyle. Here also stands the chapel of St. Oran, the first building begun by St. Columba, and Oran's red grave-stone is near the door. A little to the northwest are the remains of a cross, with a number of detached stones, they are called *clachabratti*, and visitors are enjoined to turn thrice round here, in the direction of the course of the sun. Originally, there were three noble globes of white marble, placed on three stone basons, and these turned round; but the synod ordered them, with 60 crosses, to be thrown into the sea. A little north of these is the cathedral, built in the form of a cross, 115 feet long by 23 broad, the transept 70 feet. The pillars of the choir have their capitals charged with historical devices. This building seems to have been too magnificent for the 7th century, in which it is said to have been built. The walls are of red granite, from Nun's Island. In the church yard is a fine cross of a single piece of red granite, 14 feet high, 22 broad, and 10 inches thick. Near the south-east end is Mary's chapel; behind this is a piece of the cloister of the monastery, and some sacred black stones in a corner, on which contracts and alliances used to be made, and oaths sworn. The place where St. Columba landed is a pebbly beach, where a heap of earth represents the form of his ship; near it is a hill, with a circle of stones, called the *Hill of Angels.* The ruins are, by the attention of the family of Argyle, kept in tolerable repair; but this celebrated spot, the seat of learning and piety, has now no school for education, no temple for worship, no instructor in religion.

Ionic Order. The Ionic, next to the Doric, was the oldest order amongst the Greeks. It originated amongst the Ionic colonies of the Lesser Asia, and is more delicate and graceful than the Doric, and yet has more majesty than the Corinthian. The column is fluted with twenty-four channels. The abacus of its capital is scooped on the side, and the chief ornament of the capital is its two spiral volutes. (See *Volute.*) It is supported by the echinus moulding, sculptured with the egg-and-tongue, and bordered above and below by a beaded astragal. The base consists of a torus and two scotiæ, separated by astragals, and resting on a square plinth. But the most favourite base used with this order, both by the ancients and moderns, was the attic. The cornice is in general much divided by moulding and dental bands. In most of the Asiatic remains the frieze is found wanting. In the temple of Erechtheus, the column is terminated by a fillet and astragal, and in that of Minerva Polias by a single fillet, a little below the lower edge of the volutes. In the capitals of the Ionic buildings at Athens, and of the temple of Minerva Polias at Priene, the lower edge of the canal between the volutes is formed into a graceful curve, bending downward in the middle, and revolving round the spirals. In the temple of Bacchus at Teos, in the great temple at Loadicea, and in all the Roman examples of the Ionic, the channel which connects the two volutes is not formed with a border on the lower edge, but is terminated with a horizontal line, which falls a tangent to the curve of the spiral at the commencement of the second revolution of each volute. The proportions of this order are: the whole column, 8 modules, of which the base occupies 30 lines, and the capital 20 lines, the abacus being 6½, the echinus 6½, the intervening channel 7, the whole depth of the volutes is 27 lines, depending considerably lower than the echinus; the shaft, 7⅛ modules, tapering 10 lines from the inferior diameter to the neck. The entablature, 1 module 38 lines, the architrave being 31 lines, the frieze 27, and the cornice 34. The finest specimens we have of the Ionic order are the temples of Minerva Polias at Priene, of Erechtheus, and Minerva Polias, at Athens.

Iron, (*iren*, Sax. *hairn*, Welsh.) a metal common to all parts of the world; and though recorded to have been extremely scarce among the Greeks at the time of the siege of Troy, it is now every where the most abundant and the most useful of all metals. Though the lightest of all metals except tin, yet it is the hardest, and, when pure, is naturally malleable. Most of the metals become more brittle as they acquire heat, but iron, on the contrary, is the more malleable as it approaches to fusion. Its specific gravity is to water as 7632 to 1000. It is the only known substance attracted by the loadstone. The iron manufactured in Great Britain is obtained from three kinds of ore: the *Lancashire*; very heavy, of a fibrous texture, and a dark purple colour, inclining to black; it is lodged in veins. *Bog Ore*, which resembles a deep yellow clay, found in strata of from twelve to twenty inches in thickness; and *Iron Stones*, of an irregular shape, frequently forming beds of great extent, like other stony masses, frequently intersected with seams of pit-coal. By various processes, iron is rendered fit for casting, and formed into stoves, fire-grates, and an endless variety of culinary and other utensils, and on a larger scale it supplies the place of heavy beams of timber in machinery and in building, and, when rendered malleable, it is called forged iron, and used for purposes requiring a greater degree of elasticity, and every variety of form. Besides cast and forged iron, there is an intermediate state, in which the metal is made to possess a certain degree of hardness with the necessary ductility for the manufacturing of knives, and all kinds of edge-tools, and polished ornamented goods. As early as 1779, cast iron was used for the arches of bridges, and since that time continual improvements have been made in their construction. In the Repertory of Arts for 1794, an account is given of Mr. T. Wilkinson's cast-iron blocks for forming the arches of bridges, since which, numerous similar inventions have been patented, and the principle of keystones in forming arches adopted in its utmost extent, particularly in the magnificent bridges across the Wear at Sunderland, in which Mr. Burdon, by the application of his patent iron keystones, has produced an arch at least fifteen times lighter than an arch of stone of the same dimensions, of elegant form, and very easily put together. In the sixth volume of the Repertory of Arts for 1797, an account is given of a similar invention for the same purpose, differing only in the substitution of hollow, or box-shaped, for solid key-blocks. Iron has also been used for joists, and other parts of building, to render them fire-proof; and Mr. Farrow, Ironmonger, 18, Great Tower-street, London, has procured a patent for fire-proof buildings with iron joists and rafters. A model of a house of this construction is to be seen in Mark lane.

In 1811, a patent was granted to Thomas Pearsal, of Bitton, in Gloucestershire, for the manufacture of various parts of buildings; roofs, rafters, joists for floors, skeletons for stairs, frames for windows and skylights, and various similar appendages to houses. Described in the Repertory of Arts, vol. xx. second series, 1812.—A patent was also procured by Richard Jones Tomlinson, in 1814, for a mode of covering the roofs or sides of buildings with sheet iron. Described in the Repertory of Arts, vol. xxiv. second series, 1814.—And in the same volume, a description is given of the manufacture of a patent brick, from the scoria, cinder, or slag of furnaces, cast into smooth and convenient forms for building, by Messrs. Mander, Manby, and Vernon, of Wolverhampton.

IRON CHAINS, under the roofs of circular buildings, are found of great utility in preventing the pressure of the incumbent weight from pushing out the walls, especially in domes of great magnitude. The dome of St. Paul's, in London, has two massive chains for its support, which are sunk into the substance of a circular course of Portland stone.

IRON *King Posts*, and *Queen Posts*, are generally to be preferred to those of wood, and, where bolts and straps are used, are as cheap.

IRON-WORK. Bolts, straps, and clamps, are preserved from the effects of moisture by the following mixture. Add half a pound of litharge to two quarts of boiling linseed oil, putting in small quantities at a time, and cautiously. Let it simmer over the fire two or three hours, then strain it, and add a quarter of a pound of finely pounded rosin, and a pound of white lead, keeping it in a gentle beat till incorporated, and use hot. A composition of oil and rosin, and finely levigated brick-dust, is found a most effectual preservative of iron from rust: it must be mixed, and used as a paint, of the usual consistence, and finely ground.

Irregular Figure, a figure whose sides, and consequently angles, are unequal to each other.

Isagon, (Gr. from ισος, *equal*, and γωνια, *an angle*,) a figure with equal angles.

Isiac Table, an Egyptian monument, consisting of a plate of copper, covered with various figures in basso-relievo, which was discovered at Rome in 1525, and was bought from a blacksmith by Cardinal Rembo, but it has since been lost. The principal works which treat on it are *Pignorius*, Mensa Isiaca, *Montfaucon*, Antiquitée Expliquée (tom. ii. part 2, l. 2, c. 1--3) *Keysler*, Voyages, tom i. *Banier*, *Jablonski*, and *Pignorius*.

Isidomum, or **Isodomum**, (Gr.) The Greeks had commonly two methods of building, one called *isidomum*, was with courses of equal thickness and equal lengths; in the other, called *pseudisodomum*, the heights, and thicknesses, and lengths of the courses, differed. Another inferior mode was styled *Emplecton*. See *Cella*.

Isle. See *Aile*.

Isosceles, (Gr.) a triangle which has two sides equal.

Ispahan, see *Persian Architec.*

Italian, or *Hip-roof*, see *Carpentry*.

Italy. From its proximity to Greece, Italy was one of the first of the western states of Europe, which received literature and the arts. The church of St. Mark at Venice, built by Grecian artists in the tenth and eleventh centuries, is still admired for its conception, for its antique magnificence, and for its fine proportions. The cathedral of Pisa, built in 1016, by the Greek architect Buchetto, or Buschetto, of Dulichium, is faced with marble both within and without, and is supported by four ranges of marble columns. The tower built in the twelfth century beside this cathedral, shows that architecture had already made some progress. In the thirteenth century, Lapo or Jacobo, of Florence, built the church of the Portiuncule. Contemporary with this architect, were also Fucio and Nicolas de Pise, both Florentines. The works of the latter, among which are the church of St. Antony at Padua, and that of the Trinity at Florence, were greatly admired by Michael Angelo. During the thirteenth and fourteenth centuries, a noble emulation seems to have animated all the cities of Italy. The church of Santa Maria Formosa, built at Venice, in the antique taste, by Paulo Barbetta, many monuments at Bologna, the beautiful marble chapel of the church of Santa Maria Majora at Rome, by Marchione, are all works of this period. In Italy architecture now made rapid advances towards its entire restoration. John of Pisa, in Tuscany, laboured at Campo Santo, but it was Bruneleschi who opposed most vigorously the ruling taste for the Gothic style, and who studied without ceasing the remains of ancient Rome. The treasures of the Medicis, and of the princes of Milan, hastened the progress of the arts; the works of Vitruvius were studied; and Leon Battista Alberti, of Florence, succeeded to the talents and enterprise of Bruneleschi. From that time a crowd of eminent architects have contributed towards its perfection. In the four plates of *Italian Buildings*, are given specimens of the style of buildings in that country.

J.

Jack Arch, an arch of only the thickness of one brick.

Jack of Hilton, see *Æolipile.*

Jackly, a village near Mylasa, supposed to be the ancient Labrauda, which was visited by Dr. Chandler, and plans and drawings of its temple published in the Ionian Antiquities.

"The temple, (he observes,) was of the Corinthian order, sixteen columns, with part of their entablature, standing; the cella and roof demolished." The remains of a town were also traced by it, with square towers at intervals, and walls like those of Ephesus. Within is a theatre, cut in the rock. Of the antæ and lateral walls of the pronaos, only the base is left, which is continued round the walls of the temple. The pavement of the pronaos was raised one step above that of the portico. The columns are fluted, except those on the south side, and on their front are inscribed the names of the benefactors at whose expense they were done. The projection on the front of the uppermost step has the appearance of an ovolo, though much defaced; the others are concealed under the rubbish. The entablature is left plain; it probably was intended to have been decorated, to accompany the columns, which are finished. This circumstance, with that of the columns on the south side of the temple not being fluted, shews, beyond a doubt, that the ancients were accustomed to finish the decorations after the fabric was raised: the temple of Apollo Didymeus, near Miletus, furnishes another example.

Jack Plane, a plane about 18 inches long, to prepare for the trying plane.

Jack Rafters, the jack timbers which are fastened to the high rafters, and the wall plates. See *Constructive Carpentry.*

Jack Ribs, the jack timbers, or parts of curved ribs, which are fastened to the angle ribs, and rest upon the wall plates, in groined or domed ceilings.

Jack Timber, a short timber fastened at the ends to two timbers which are not parallel, or to two timbers which actually meet in a point, as to the wall-plate and hip-rafter of a roof, the wall-plate and hip of a groin, &c.

Jambs or *Jaumbs*, (Fr.) door-posts, or upright posts at the ends of window-frames, also the upright sides of a fire-place, from the hearth to the mantel-piece.

Jamb-lining, the side work of door-ways.

Jamb-posts, uprights on the sides of door-ways, on which the jamb-linings are fixed.

Japanese Houses (says a late traveller) are the antipodes of those of the ancient Egyptians, and the inhabitants of the Hauran. While the latter, always aiming at massiveness, constructed their houses of huge stones, and roofed them with the same materials, you here see, upon the green knolls that skirt the road, little delicate habitations of fine wood, or even of paper. But their light and graceful structure, and their gilded ornaments, glittering in the sun, give them the air of fairy dwellings, which the very breath of heaven might dissolve.

Java, an island in the East Indies, in which remains of splendid buildings, laying claim to the highest antiquity, are yet to be seen. "Nothing, (observes Captain Baker) can exceed the air of melancholy, desolation, and ruin, which this spot presents; and the feelings of every visitor must be in unison with the scene, when he reflects upon the origin of this once venerated, hallowed spot; the seat and proof of the perfection of arts, now no longer in existence in Java, and the type and emblem of a religion no longer acknowledged, and scarcely known among them by name. Never have I met with such stupendous and finished specimens of human labour, and of the polished refined taste of ages long since forgotten, crowded in so small a space. And though there may be remains of antiquity in other parts of the globe, equally worthy the eye of the traveller or the pencil of the artist, yet *Chandi Servo* must ever rank with the foremost in the attractions of curiosity, or of antiquarian research." The most splendid of these monuments of antiquity are at Prambanan, Boro-Bodo, and Singa Sari. The ruins of Boro-Bodo is remarkable for grandeur of design, and exquisite workmanship. This temple is under the residency of Kadu, its name being a corruption of Bud'ho, ancient or heathen. The building crowns the summit of a hill; its form is quadrangular, and rises by seven terraces, one above another, each enclosed by a stone wall; flights of steps at the four corners, leading to the top, on which are four latticed domes, with one of a larger circumference. Upwards of 300 stone images of devotees occupy as many niches, or temples, in the walls; these are above three feet high. Similar images are also in the domes above, both within and without, carved in relief, in the most correct and beautiful style. Historical scenes and mythological ceremonies are represented by groups of figures; they are in the Indian costume; and the extent and grandeur of the whole is wonderful, and beautifully correct in the workmanship; but one of the most extraordinary monumental assemblage of wonders, is an immense colossal statue of a man resting on his hams, lying on its face, and adjacent to a terrace on which it was originally placed. It measures in length 12 feet, with corresponding dimensions in all its parts; it is cut from one solid stone. The terrace from which this enormous statue appears to have fallen, is about 18 feet high, and could not have been raised to that station by any machinery at present in possession of the natives of Java. A second figure of this description has been lately discovered; and in the district of *Malang*, not far from Singa-Sara, several interesting ruins of ancient temples have been found.

Jerkin-head, is a peculiar feature in roofs, in which the gable is carried higher than the side walls.

Jet-d'eau, (Fr.) water thrown into the air from a pipe or tube placed in the middle of a basin, and falling again into the basin below.

Joggle Post, a strut-post for fixing the lower ends of the struts. See *Crown*.

Joists, for floors of the simplest construction, are placed with their edges uppermost, extend from wall to wall, and are generally broad and thin; these floors are called single-jointed, excepting large timbers, called beams: all the cross pieces supporting the boards of a floor are called joists; and if cross pieces are fixed to the beams underneath, to sustain the lath and plaster, these are called ceiling joists. Bridging joists are those to which the boards are nailed.

The binding joists are those into which the bridging joists are mortised. See *Bay*, and *Carpentry*.

Joinery, in building, is confined to the nicer and more ornamental, as carpentry is to the stronger and more ponderous, parts. White and yellow deal, mahogany, and American oak, are the woods generally used by the joiner, who, in selecting, always gives the preference to such pieces as are free from knots, and straight-grained; the yellow deal is in general the least liable to these imperfections, and therefore best for styles of doors and framing, and mouldings of every description. White deal is to be preferred for panels, which should be cut down the middle, and joined again, an edge to a middle, whether the panel require two, three, or more pieces, carefully avoiding knots on the edge of the joint, which if admitted will cause it to fly, even in dry wood. The straightest logs should be selected for wainscots, of a clear grain and an uniform colour. A log of wainscotting ought to be cut in a direction opposed to what workmen call the *beat* of the wood, in order that it may have a handsome variegated appearance; for the styles and frames of doors, sashes, &c. wood cut in the same direction as the *beat* will make better mortises, and be less liable to split or warp. Mahogany is used only for the doors, sash frames, banister rails, and other parts of the most elegant houses. Spanish mahogany is harder than that from Honduras, and also, when it is variegated, is far more beautiful. The species of mahogany, called *Ratteen*, is of the cheapest kind, and sometimes used for panels of large dimensions, and is preferred for sign-boards, the facings of shops, and what the workmen call sweep work; it is less liable to be affected by the weather. For polishing wainscot work, the joiner dissolves thin shavings of bees-wax in spirit of turpentine, without heat, in a glazed earthen pan, stirring it frequently, and, by adding of either article, keeping the compound of the consistence of honey; this application put on with a linen rag, and rubbed till it will not adhere to the fingers, gives a fine polish; or to a quart of linseed oil a pint of spirit of turpentine is added, and a small quantity of lime; it is kept hot beside the fire two or three hours, strained through a cloth, and kept for use; this is applied with a brush, and after twenty-four hours is to be rubbed with oak saw-dust, finishing with a clean linen rag; or to polish and heighten the colour at the same time, gently boil one quart of linseed oil with half an ounce of litharge for an hour or more, then strain and mix with half a pint of spirit of turpentine, in which a sufficient quantity of pounded turmeric has been left to macerate. This, mixed with the oil and litharge, is to be applied with a brush or rag, and after an interval of a day may be repeated, by which the work may be rendered very beautiful.

In joints of boards, it is in general only necessary to ascertain the perfect truth of the joint, and that it is, as the workmen say, out of winding; to apply the glue quite hot, and rub the edges against each other till it become nearly cold; but if the wood be porous or spongy, by previously rubbing the joint with soft chalk, and wiping away all loose particles, the operation will be more effectual.

The workman, after glueing up his work, suffers it to remain at rest a short time till the glue stiffens; that which escapes from the joints is then carefully scraped off with a chisel, and all the corners cleaned out with a sponge slightly moistened with hot water; the work then remains till perfectly dry, after which a fine smoothing-plane is used, to take off all unevenness about the joints; and lastly a smooth scraper and fine glass-paper are applied. Sometimes it will be necessary to damp the whole over with a sponge, to raise the grain, and afterwards apply the glass-paper, when the work will be ready for polishing with wax, oil, or varnish.

Joint. See *Abreuvoir*, *Butjoint*, and *Constructive Carpentry*.

Jointer, the largest kind of plane, termed also *jointing plane.* In bricklaying the term is applied to a piece of iron bent in two opposite directions, and sometimes used in building a wall.

Jointing Rule, a rule used by bricklayers for securing a straight face to their work.

Jones, Inigo, a celebrated English architect, the son of a clothier in London; he was born in 1572. He was put apprentice to a joiner, but soon distinguished himself by a taste for drawing, particularly in landscape drawings and painting: he was patronised by William, Earl of Pembroke, who sent him abroad with a handsome allowance, to perfect himself in that art. He was no sooner at Rome, than he found himself in his proper sphere; he felt that nature had formed him, not to decorate, but to design palaces. His first work was Whitehall. Christian the Fourth, of Denmark, invited him to his court, and appointed him his architect. He was afterwards architect to Queen Anne. He served Prince Henry in the same capacity, and the place of surveyor-general of the works was granted him in reversion. On the death of his patron he travelled again into Italy, and on his return the surveyor's place fell to him, and he, with uncommon disinterestedness, gave up the profits of his office, which he found greatly in debt, and also prevailed on the comptroller and paymaster to imitate his example, till the whole arrears were cleared. In 1633, Laud, then Bishop of London, laid the first stone of St. Paul's Cathedral, and Inigo the fourth, and after completing that structure, he successively designed some of the most splendid erections in London, among which are the chapel ot Lincoln's Inn; the Banqueting House, begun in 1619, and finished in two years. This is a beautiful model of pure taste. Surgeon's Hall is one of his best works; and of the most admired are the Arcade of Covent Garden, and the Church. One of his most beautiful works is the Queen's House, at Greenwich. He early tasted the misfortunes of his royal master. He was not only a favourite, but a Catholic; and in 1646 he paid £544 for his delinquency and sequestration. He and Stone, the mason, buried their joint stock in Scotland yard. Grief, misfortunes, and age, put an end to his life at Somerset House, July 21, 1651.

Judgment Gate. See *Almahara.*

Juffers, an antiquated term for pieces of wood four or five inches square.

Jumper, a name given by masons and miners to a long iron chisel used in boring shot-holes for blasting large masses of stone, by which they may be split into smaller ones.

K.

Kaaba, see *Caaba*.

Kang, or *Chinese Stove*, is heated by a furnace, which casts all its heat into it. The furnace is proportioned and fitted to the stove, and may be placed either in the room, or on the outside of the house. The heat of this furnace, impelled by the outward air, rushes through a slit into a tubular conductor, and passing from this into another pipe at right angles to it, lying under the middle of the floor of the stove, issues through vent-holes in the last pipe, and is communicated to the bricks which form the pavement of the stove, and from them to the whole room. The smoke is carried off by funnels at both ends of the stove. See a drawing and description in the Philosophical Transactions, vol. lxi. part 1. article 7.—It is observable, that in order to draw off the pernicious vapours arising from the coal fire, water-pots are placed in the rooms, and the emperor's apartments in the palace are decorated with flower-pots, with little orange-trees and other plants; and the Chinese philosophers assert, that this is the best method of sweetening the air; a doctrine perfectly consistent with the opinions of European chemists.

Keep, (Sax.) sometimes styled emphatically the *tower*, the strongest part of the old English castles, forming the citadel of the fortress. It was generally near the centre of the fortified works, but in some instances, as at Portchester, Goodrich, Castleton, and other very ancient castles, it is found placed in a line with the exterior walls. Its massive walls and narrow loop-holes were calculated to afford defence in the last extremities of a siege. It has sometimes been denominated the *Maiden* tower, but this term does not refer to its being the habitation of the ladies, but it appears to be a corruption of the old French *magne* or *mayne*, great. See *Castle* and *Don Jon*.

Keraunoscopeion, (*κεραυνος*, *lightning*, *σκοπεω*, *I behold*, Gr.) a machine used in the theatres of the ancients, to represent the lightning of Jupiter. Another machine, called *bronteion* served to imitate thunder.

Kerf, the slit or cut in a piece of timber, or in a stone, by a saw.

Kerkis, in the plural *kerkides*, (*κερκις*, Gr. *the radius of a circle*,) a name which in the theatres of the ancients designated the stairs which crossed the ranges of seats like radii of a circle, and which were carried from the orchestra to the outermost circumference of the seats. See *Theatre*.

Key, (*cæg*, Sax.) In the earliest times, the locks and keys were very simple, the former being but a bar of wood, and the key a hook by which it was raised or drawn back. By degrees they became more complicated. The keys of the ancients were generally of bronze; they had an infinite variety of forms, and they were sometimes so large and heavy, as to require to be carried on the shoulder.

Keyed Dado, so named on account of its being secured from warping by bars grooved into it, on the inside.

Keys, in naked flooring, are pieces of timber fixed in between the joists by mortise and tenon. When these are fastened with their ends projecting against the sides of the joists, they are called *strutting pieces*.

Key *of a floor*, the board last laid down.

Keys, pieces inserted in boards to prevent warping.

Key-stone, the stone placed in the centre of the top of an arch or vault. See *Crown* and *Console*. The character of the key-stone varies in the different orders. In the Tuscan and Doric it is only a simple stone projecting beyond the rest: in the Ionic, it is adorned with mouldings in the manner of a console; in the Corinthian and Composite, it is a rich sculptured console. The degree of ornament on the key-stone is usually regulated by the general character of the building. The ancients have left us several fine models of ornamented key-stones of arcades and arches, which generally represented some ornament or figure that related to the building. Those of the arcades of the amphitheatre of the ancient Capua are adorned with heads, in high relief, of the divinities to which it appears to have been consecrated. The key-stones of triumphal arches were ornamented with allegorical symbols and figures allusive to the subject. That of the arch of Titus is the finest known.

Mr. Burden, the architect of the bridge at Sunderland, who first formed an arch of iron on the same principle as the stone arch, obtained a patent for making blocks of iron as substitutes for key-stones of arches, possessing great lightness, with all necessary strength. These blocks in the widest part measure 5 feet 2 inches, and in thickness 4 inches, being in the form of a kind of frame-work. Each block weighs four hundred weight, and they are fixed together by pins and bars of iron.

Knee, a part of the back of a hand-railing, of a convex form, the reverse of a *ramp*, which is a back of a hand-rail, and is concave. The name of *Knee* is also given to any small piece of timber of a bent or angular form.

Knee, *Knee-piece, or Knee-rafter*, an angular piece of timber, to which pieces of timber in a roof are fastened.

Kilcullen's Cross. See *Cross*.

Kiln, a building for the accumulation and retention of heat, in order to dry or burn certain materials deposited within them. See *Bricks*, and *Lime*.

King Post, the middle post in a roof. See *Crown*.

Kitchen, (*cuisine*, Fr. perhaps from *culina*, Lat. *kegin*, Welsh.) that part of the office of a house where the business of cooking is carried on.

Knotting, a process to prevent the knots appearing, by laying on a size composed of (1) red lead, (2) white lead and oil, or (3) a coat of gold size, (which last is always effectual,) as the preliminary process of painting.

Knuckle, the joint, of a cylindrical form, with a pin, as an axis, by which the straps of a hinge are fastened together.

Krade, (Gr.) a machine in the ancient theatres by which the gods and heroes were represented traversing the air, by means of a chair and ropes.

L.

Label, in Gothic architecture, the drip or hood-moulding of an arch, when it is returned square.

Labyrinth, (Lat.) a building full of numerous and intricate passages. The most celebrated labyrinth of antiquity was that of

Egypt, which was situated above lake Mœris, near Crocodilopolis, or Arsinoë, in the district now called *Fejum*, or *Fium*. The builder of it, or the use to which it was applied, is unknown. Some have regarded it as a kind of pantheon, where they sacrificed to all the Egyptian deities; others have thought that it was appropriated to the celebration of religious mysteries; and others have imagined that it was dedicated to the sun, and represented the zodiac, and the course of the great luminary, and of the planets. See Paul Lucas's "Voyages dans la Grèce," &c. and the same author's "Voyages dans la Turquie," &c. Pauw's "Recherches sur les Ægyptiens," Pococke's "Travels in the East," Gatterer's "Weltgeschichte in ihrem ganzen Umfange." The same author's "Article de Metempsychosi," &c. in the "Commentar. Soc. Scient. Gött." &c. vol. v. and ix. Savary, "Lettres sur l'Ægypt." Banier, "Mémoire sur les Palais de Caron," &c. in the fifth vol. of the "Mémoires de l'Acad. des Inscript." and the various travellers in Egypt.—The *Labyrinth of Crete*, is reported to have been built by Dædalus, in imitation of that of Egypt. In the time of Pliny and Diodorus it had ceased to exist.—The *Labyrinth of Porsenna*, near Clusium in Etruria, appears to have served for the sepulchre of that prince. It is described by Pliny, and a conjectural plan of it is given in the Memoirs of the Academy of Cortona, tom. ix. p. 80. There was also a labyrinth of some celebrity at Lemnos; and, according to Strabo, there were caverns near Nauplia, in Argolis, which contained a labyrinth, denominated *Cyclopea*.

Labyrinth Fret, a very ancient ornament, in form of a labyrinth, with numerous turnings and involutions.

Lacunar, (Lat.) panels or coffers in ceilings, or in the soffits of cornices; the flat roof of a room: a roof when vaulted was termed *camera*.

Lacunaria, (Lat.) the ceiling of the ambulatory around the cella of a temple, or of the portico.

Laconicum, (Lat.) one of the apartments of the ancient baths, so called from its having been first used in Laconia.

Lactaria Columna, see *Column*.

Lady Chapel, the name given to a small chapel, generally found in ancient cathedrals, behind the screen of the high altar. It is usually dedicated to the Virgin Mary; by Catholics, called *Our Lady*.

Laquearii, (Lat.) among the Romans, the workmen who made the *laquear*, or *lacunar*. See *Lacunar*.

Lancet, see *Gothic Architecture*.

Landing, the terminating of a stairs, or a broad step where the entrance to a room occurs in the course of a staircase, or stairs.

Lantern, in Gothic architecture, a turret, placed above a building, and pierced with windows. Beautiful specimens of the ornamented open lantern or *louvre*, are preserved in the cathedrals of Peterborough and Ely. Lanterns of open stone-work, erected on lofty church towers, of a more recent date than the Anglo-Norman era, are supposed by some writers to have been intended to hold lights in aid of the traveller. The lantern of the steeple of Boston church, Lincolnshire, Mr. Britton says, (Architec. Antiq. vol. iv. p. 118) was no doubt, intended to be lighted at night for a sea-mark. The church of All Saints, at York, has a lantern much resembling it, "and tradition tells us, that anciently a large lamp hung in it, which was lighted in the night-time, as a mark for travellers to aim at, in their passage over the immense forest of Galtres to this city. There is still the hook of the pulley on which the lamp hung in the steeple." Drake's York, p. 292. Lanterns are used to cover the overtures on the top of cupolas. Some suppose that the *tholus* mentioned by Vitruvius, was something of this kind, but Winckelmann, with some others, have imagined it to be the cupola itself. See *Tholus*.

The name of lantern is given also to a square cage of carpentry placed over the ridge of a corridor or gallery, between two rows of shops, to give light, as in the Royal Exchange, London.

Lantern *of Demosthenes*, see *Athenian Architecture*.

Lararium, (Lat.) a kind of domestic chapel in the Roman houses, dedicated to the worship of the *lares*, or household gods.

Larmier, (Fr.) the same as the corona, the upper member of a cornice. In Gothic architecture it is a kind of plinth, the upper surface of which is inclined, and the inferior part hollowed in a round canal, to throw the water from the wall.

Latch, the simplest kind of fastening to a door.

Lath, a long narrow slip of wood, nailed on the rafters of a roof, for receiving the plaster. Latin authors give the names of *ambrices*, *templa*, and *ligatura*, to those parts of the frame-work of ceilings which are also used in plaster partitions. Laths are of three kinds, *heart* of *oak* laths, *sap* laths, and *deal* laths. The first sort, as the most durable, are used for tiling; the two last, only, for ceiling and partitioning. Laths are cut in lengths of three, four, and five feet; yet the statue only allows of five and three feet lengths, each of which are to be an inch and a half in breadth, and half an inch in thickness.

Lath-bricks, a particular sort of brick, made in some parts of England, of twenty-two inches in length, and six inches broad. They are used for drying malt, for which they are well adapted, and retain heat a long time.

Lattice, (*lattis*, Fr.) a reticulated window, made of laths or slips of iron, separated by glass windows, and only used where air, rather than light, is to be admitted, as in cellars and dairies.

Laundry, a spacious and well-lighted apartment, which is in the occupation of the laundress, who will need every thing convenient for mangling, ironing, and drying the linen of the family; these are, a stove to heat the irons, and for drying; with a range of grating, and other conveniencies. The stove must have an iron pipe, conducted in several directions about the room, to give out heat, and at last inserted in the chimney flue, near the ceiling. Horses, or slender frames of wood, are provided, to hang the linen upon; and these are occasionally drawn up to the top of the room, where the heat being greater than below, the drying will be sooner completed. A water-pipe, for the use of the work-women, and various other requisites, should be provided..

Laura, a collection of little cells, or monkish habitations, contiguous to each other, in which hermits, in ancient times, lived together in a wilderness. Of the most celebrated Lauras of antiquity were, that of St. Euthymius, four or five leagues from Jerusalem; the Laura of St. Saba, near the brook Cedron; and that of the Towers, near Jordan.

Layer, a stratum, or row, one laid upon another, *stratum super stratum;* applied to the stones or bricks, and synonymous with courses.

Lazaretto, (Ital.) a hospital for the reception of persons sick of contagious disorders, the wards of which are quite isolated.

Lead, (*læd*, Sax.) the heaviest metal except gold and quicksilver, of a bluish white when first broken; specific gravity 11,450, less hard, less elastic, less tenacious, and less sonorous, than any other metal; soluble in all acids and alkaline solutions; fusible before ignition, and easily calcined. It is found mineralized with sulphur, with a slight mixture of silver and antimony: in diaphonous, prismatical crystals, generally hexagonal; white, yellowish, or greenish, in the Mendip hills, in Somersetshire. Near Bristol, and in Cumberland, it assumes the form of a white, grey, or yellowish spar, without the least metallic appearance; in some places it is in the state of native ceruse, in a white powder; and in Monmouthshire, it has been found native, or in a metallic state. The metal of lead is easily rolled out into very thin plates. Next to tin, it is the most fusible of metals. Plumbers purchase the lead as it comes from the manufacturer, in *pigs*, which they reduce to forms suitable to their purposes: for buildings, they have cast sheet-lead, used for flat roofs, for terraces, gutters, and the sides and bottoms of reservoirs, and similar purposes. Rolled lead is very thin, for putting over ridges and angles of roofs, and in various situations, as a protection from the weather. Leaden pipes are used to convey water from the gutters of the roofs of houses, and for other purposes.

Lean-to, the name given to a small building, whose side-walls and roof project from the wall of a larger building.

Ledge, or *Ledgement*, a projection from a plane, as the slips on the sides of window-frames to keep them steady in their places, or those against the door-frame, against which the door shuts.

Ledgers, the horizontal pieces fastened to the standard poles or timbers of scaffolding, raised around buildings during their erection; those which rest upon the ledgers are called putlogs, and on these the boards for working upon are laid.

Legs *of an Hyperbola*, are the two parts on each side of the vertex.

Legs *of a Triangle:* when one side of a triangle is taken for the base, the other two are called the *legs*.

Length, (*leng*, Sax.) length, and breadth also, are understood, as applied to the ground, or the floors, or the horizontal plane which the building occupies: the dimensions of an ascending vertical line, is called height; and the same line measured downwards, gives what is called the depth of an apartment, or a building.

Lesche, amongst the Greeks, the name of a building, or hall, used for public resort.

Level, (*læfel*, Sax.) a surface which inclines to neither side. There are several instruments used to take levels: as, the *Air Level; Water Level; Pendulum Level; Reflecting Level; Mason's Level; Carpenter's* or *Bricklayer's Level*, &c. The *Air Level*, invented by Dr. Hooke, shews the line of level by means of a bubble of air, enclosed with some liquor in a glass tube.—The *Water Level*, which resembles the *chorobates* of the ancients, shows the horizontal line by means of a surface of water or other fluid.—A *Carpenter's Level*, consists of a long ruler, to the middle of which a broader piece is fitted at right angles, with a plummet hanging down it.—The *Mason's Level*, is formed of three pieces of wood, joined in the form of an isosceles triangle, having a plummet suspended from the vertex, over a mark in the centre of the base.

Levelling, the art of discovering a line parallel to the horizon at several places, to determine heights or depths.

Library, (*bibliotheca*, Lat.) an apartment to contain books.

Liburnæ, (Lat.) a species of Roman swift ship, with two sets of rowers.

Line, (*Linea*, Lat.) in Geometry, that figure which has only length. *Lines of the Sector and Scale*: see *Instruments*. *Horizontal line*, in perspective, the common section of the horizontal plane, and that of the draught or representation, passing through the principal point: in Dialing, it is the common section of the horizon and the dial plane. Other lines in perspective are, the *Geometrical line*, a right line drawn any way on a geometrical plane: *Terrestrial line*, the line of intersection between the geometrical plane and that of the picture: *Line of the front*, the common section of the vertical plane and that of the picture: *Line of station*, the common section of the geometrical and vertical planes, or, according to others, the perpendicular height of the eye above the geometrical plane: *Objective line*, the line of an object, from whence the appearance is sought for in a picture; *Vertical line*, the line intersecting a vertical plane: *Visual line*, a reflection of light from a visible object: *Line of direction*, that in which motion is given to a moveable body: *Line of light*, that which defines the light parts of bodies diversified by light and shade, of which the shaded part is defined by the *Line of shade*. The *Lines of division* or *gradation*, denote the arithmetical, or geometrical proportions into which a body may be divided. In France, the name of *line* is given to a measure which contains the twelfth part of a foot. In fortification, a *Line of defence*, is a line supposed to represent the flight of a ball: the *Line forming the flank*, is a line drawn from the angle formed by the two demigorges of the bastion, to the angle at the flank; the *Capital line*, is a line drawn from the point of the bastion to the point where the two demigorges meet: the *Line of circumvallation*, is a line or trench cut by besiegers round their camp: the *Line of contravallation*, is a ditch bordered by a parapet, serving to cover the besieged: *Lines of communication*, are trenches that run from one work to another: a *Line of approach*, or *attack*, is the work which besiegers carry on under cover, to gain the moat and body of the place.

Light-house, a high building, on the top of which lights are placed, to guide ships at sea. These erections were called by the Saxons, *becns* or *beacons*, originally signifying signals, and serving either to prevent shipwrecks, or to give notice of invasions: for the latter purpose, the *green flame*, and the *fire cross*, were peculiarly adapted. The light-house is generally erected upon a cape or promontory on the sea-coast, or upon a rock in the sea. Lamp-lights are on many accounts preferable to coal-fires or candles; and the effect of these may be increased by placing them either behind glass hemispheres, or before properly disposed glass or metal reflectors; which last method is now very generally adopted. In England it is a branch of the royal prerogative to erect these landmarks, for guiding and preserving vessels at sea, by night as well as by day; and the king has the exclusive power, by commission under the great seal, to cause beacons, light-houses, and sea-marks to be erected in convenient places, as well upon the lands of the subject, as upon the demesnes of the crown; which power is usually vested by letters patent in the office of lord high admiral. And by statue, 8th Elizabeth, c. 13. the corparation of Trinity-house are empowered to set up any beacons or sea-marks, whenever they shall think them necessary: and if the owner of the land, or any other person, shall destroy them, or shall take down any steeple, tree, or other known sea-mark, he shall forfeit £100, or, in case of inability to pay it, shall be *ipso facto* outlawed.

The light-house on the Eddystone rocks has already been described under the article *Eddystone*. The friths of the Forth and the Tay are secured by several light-houses. On the isles of Inchkeith and May are two small light houses; a third is erected on Cape North, at the mouth of the Tay, and a signal or beacon is placed upon the Carr-rock, near Cape South. But the grand light-house is situated on the Bell-rock, which warns the mariner of a vast and dangerous reef of rocks, in front of the Tay and the Forth, advanced a considerable way into the sea. In former times, to warn sailors from these rocks, the monks of Aberbrothock, or Aberbroath, are said to have placed a large bell, called the *Inch Cape Bell*, on the principal rock, whence it received its name. The Bell-rock light-house was built on the same plan as that of Eddystone, with the improvements in lighting which have been since made. It was begun in 1807, and in December, 1810, the lantern which had been previously made and fitted in Edinburgh, was placed upon its elevated position. During the erection, a temporary edifice was built, for the shelter and convenience of the workmen. It was constructed with timber, well secured with iron stanchions. *Fig.* 6, *(Pl. Light-house)* represents two of the bracing chains, with their tightening shackle, meeting in the ring which is fixed to one of the batts, which were sunk into the rock about twenty inches, and immoveably wedged with timber and iron. The lowest story (*fig.* 7.) of this temporary erection served as a forge, and had a space for mixing the mortar for the building: the figure represents the floor of this apartment, showing the situation of the mortar tubs and lime casks, and the smith's bellows, fire-place, and anvil. The floor immediately above this was occupied by the kitchen, the next was fitted up for the accommodation of the architect and conductors, and the highest served as a bedroom for the workmen. The light-house is of a circular form, and composed of blocks weighing from 4600lbs to 5500lbs. A general elevation is given in *fig.* 1. and a section in *fig.* 2. The lowest course is forty-two feet and two-thirds in diameter. The entrance is on the twenty-seventh course, 32 feet 8 inches above the rock at the foundation of the first stone. The stairs are 30 feet long in the centre of the tower, the walls of which are here 7 feet thick. The provision store occupies the floor of the thirty-ninth course, and is entered from the stairs of the landing: in the section of this room, in *fig.* 2 are seen the machinery for raising the stores, &c. The next room is the light-room store, the floor of which is on the 48th course, 55 feet 10 inches above the foundation. The next is the kitchen, its floor on the 57th course, 65 feet 8 inches above the foundation. Above this is the bed-room, the floor of which occupies the 66th course, 75 feet 8 inches above the foundation. The last room is the stranger's room or library, on the 78th course, 85 feet 11 inches above the foundation. *Fig.* 4 is a plan of the light-room floor, 86th course, 97 feet 9 inches above the foundation: in the centre is shown the drum or barrel on which the rope is coiled, which gives motion to the machinery both of the lights and the bells. The weight which causes the movement is shown in the foundation, *fig.* 2; the rope is carried down through the various floors of the whole building, by means of pulleys, &c. and will be traced in the very fine line from the drum to the cavity in the solid courses: the two bells are also shown on this floor. *Fig.* 5 is a plan of the lantern, shewing the reflectors, frame, &c. The upper and lower sides are the white lights: the right and left sides are the red lights. The sill of the sash of the frame is 102 feet 6 inches above the foundation, and the cupola is 13 feet 4 inches higher. The lighthouse was lighted for the first time on February 2d, 1811. The light is brilliant and powerful, alternately red and white, and may be seen distinctly, when the sky is clear, at a distance of eight leagues. The reflectors are fixed upon a large iron frame, which presents four vertical faces. For a warning in misty weather, when the light is not visible, two bells, each weighing a hundred weight, are tolled day and night, by the machinery which imparts motion to the reflectors. Signals are made to the keepers who are on shore, by means of a ball painted black, and a vertical staff which passes the centre of it.

Like Arcs, segments of circles which are contained by equal angles.

Like Figures, such as have their angles equal, and the sides about those angles proportional.

Like Solids, such as are contained under like planes.

Lime-Kiln, Cato has given us a description of the ancient lime-kiln. Its form was that of a cone: its height commonly twenty feet, its breadth at the base ten, at the top three. The greater half of the base consisted of a ditch dug in the ground; the part above the earth was constructed of bricks or stone, plastered with mould. At the summit was an opening to let out the smoke. In the kiln a vault of limestone was formed over the fire, and afterwards all the superior part was filled with limestone. Under the emperors certain criminals were condemned to work at the lime-kilns.

Lime is prepared for mortar, by burning in kilns in modern, in precisely the same manner as in ancient times, and it is from this circumstance, that all stones from which quicklime is produced are called calcareous or calcinable. To convert carious stones into quick lime, they are kept in a kiln, at a white-red heat, for the space of twelve or fourteen hours; or the same purpose may be attained by keeping the stones a longer time in a lower degree of heat; but if the heat be too great, vitrification takes place.

Lining, covering for the interior, as casing is covering the exterior surface of a building.

Lining *of a Wall*, a timber boarding, whose edges are either rebated, or grooved and tongued.

Lining-out, the marking lines where timbers are to be cut.

Linings *of Boxings* for window shutters, the wainscot framework into which the window shutters fall, when folded back from the window.

Linings *of a Door*, the linings of the sides of apertures of doors, called also *jambs*, or *jamb linings;* and that which covers the top, or head, is called the *soffit*.

Lintel, (Fr.) the horizontal piece which covers the opening of a door or window. Vitruvius terms it *antepagmentum superius*. Lintels, in some old authors, are called *wall-plates*.

List, or *Listel*, (Fr.) a little square moulding, serving to crown or accompany a larger, also termed a *fillet*.

Listing, the cutting the sapwood out, from both edges of a board.

Lithostraton, (Gr. from λιθος, *stone*, and στρωννυμι, *to pave*,) a Greek term for a species of mosaic, termed by the Romans *opus sectile*, and consisting of pieces of marble of a certain size. Another variety was termed *opus tesselatum*, or *vermiculatum*.

Lobby, (*laube*, Germ.) an open space, surrounding a range of chambers, or seats in a theatre, a small hall, or waiting room.

Lock, (*loc*, Sax.) an instrument for fastening doors.

Lock Weir, or *Pound Lock*, consists of a deep bason or reservoir, in a canal, closed at each end by gates, which successively opening and shutting, allow the water to rise or fall, in order to afford the means of raising boats as they pass up the course of a canal, or lowering them as they pass down.

Lodge, (*logis*, Fr.) a small house in a park or forest.

Logeum, (λογειον, Gr.) the pulpitum, or wooden stage of a theatre, placed upon the proscenium, or permanent stage.

Loghouse, temporary habitations, made of branches of trees, or logs of wood.

Logistic Spiral, or *Proportional Spiral*, a spiral whose radii are in continued proportion, where the radii are at equal angles.

Longimetry, the art of measuring lengths, accessible and inaccessible.

Loop, (Fr.) a small narrow window.

Lorimer, the name given to a square member, under, or forming part of, a cornice, which projects, and has a groove in its under side.

Lorme, Philabert, a celebrated French architect, born at Lyons, early in the sixteenth century. At the age of fourteen he went to Italy to study the art to which he had devoted his attention, and soon became noticed by Cardinal Cevino, who took him into his palace. In 1536, he returned into his native country, and constructed the Horseshoe, at Fontainbleau, and the chateaus of Anet and Neudon, for Henry the Second. On the death of this king he was made inspector of the royal buildings, by Catherine de Medicis, under whose direction he commenced the building of the Thuilleries; and in 1555, was created counsellor and almoner to the king, and was presented with two abbacies for his services. He died in 1667. He wrote *Dix Livres d'Architecture*, and *Nouvelles Inventions pour bien Bâtir et à petits Frais.* He had the honour of introducing a taste for Grecian architecture into France.

Losange, (Fr.) "a figure of four sides, with two acute and two obtuse angles." *Millin.*

Lotus, a plant of great celebrity amongst the ancients, the leaves and blossoms of which generally form the capitals of Egyptian columns. It is mentioned in the scripture, under the name *dudiim.* See *Sprengel,* Antiquitatum Botanicarum specimen.—*Mahudel,* Memoire sur le Lotus, in the Memoires de l'Academie de Belles Lettres, tom. ii.—*Savigny,* Description du Nymphæa Cœrulea, in the Annales Musée d'Histoire Naturelle, tom. i.—and *Delille,* sur le Lotus d'Ægypt, in the same volume.

Louvre. See *Lantern.*

Luffer Boarding, boards nailed on the sides of buildings, or lanterns, or across apertures, arranged and fixed so as to admit air, but to exclude rain.

Lunette, (Fr.) cylindric, cylindroidic, or spherical apertures in ceilings, of the same form as the upper lights in the nave of St. Paul's Cathedral, in London.

Luthern, the same as *Dormer.*

Lying Panels, those which are cut out with the grain of the wood, not, as is usual, with the grain in a vertical, but a horizontal direction.

Lysicrates. See *Athenian Architecture.*

Lysis, (perhaps from the Greek *αλυσις*, a *chain*, or *band*,) a kind of plinth, or step, above the cornice of the podium of ancient temples, which surrounds or embraces the stylobate, as may be observed in the temple of Fortuna Virilis.

M.

M Roof, the junction of two common roofs, with a vallum between. The letter ʍ inverted would also correctly represent this kind of roof.

Machicolations, (*machicoulis*, Fr.) in old castles, "over gates, are small projections, supported by brackets, having open intervals at the bottoms, through which melted lead and stones were thrown down on the heads of the assailants." *Grose.* Machicolations, however, were not always projecting works, but sometimes consisted of rows of square holes in the vaulting of portals, for the same use. As castellated edifices became more magnificent, these became ornamental works over the principal gates. Sculpture, however rude, was admitted at an early period, either over the machicolation of the gates, or in the grotesque figures used as water-spouts, &c. Over the grand entrance into Caernarvon castle, is the statue of Edward I. drawing his sword in an attitude of defiance.

Macra Teiche, (*τα μακρα τειχη* or *τα σκελη*, the *long walls*,) the fortified walls which joined the citadel and the maritime city at ancient Athens, and which were flanked at intervals with towers, some traces of which are still to be seen. They formed, together with a portion of the walls of the Asty (city) and of the Peiræus, at either end, an enclosure, which was one of the three great garrisons into which Athens was divided, and which, in this light, was sometimes denominated the long fortress, *το μακρον τειχος*. At the beginning of the Peloponnesian war, when the greater part of the population of Attica crowded into Athens, its towers, and those of the two cities, furnished dwellings to the fugitives from the open country. The long narrow space between the two walls was covered with dwellings, and was thickly inhabited as long as Athens remained flourishing and populous. When Athens fell into the power of the Lacedemonians, these walls were demolished. Some writers have supposed that there were three walls, but Leake (Topography of Athens) has proved satisfactorily that this is a mistake. The vestiges which remain are chiefly towards the lower end, where they were connected with the fortifications of Peiræus and Phalerum. The modern road from Athens to port Dhrako, about two miles from the latter, comes upon the foundations of the northern wall, which are formed of vast masses of squared stones, about twelve feet in thickness. Precisely parallel to it, at the distance of 550 feet, are traced the foundations of the south wall, to the Peiraic peninsula, and other vestiges are found in the vineyards. The southern wall appears to have terminated in a round tower, at the heights near the angle of the Phaleric bay.

Maderno, Charles, an architect of considerable eminence, born in Lombardy, in 1556. He was put under the care of his uncle Dominico Fontana, at Rome, and at an early age distinguished himself as a sculptor; but being left by his uncle to superintend an architectural erection of some importance, he completed the undertaking with so much skill and judgment, that he was earnestly advised to exchange the study of sculpture for that of architecture. His first work of note was a magnificent monument over the remains of Sixtus V. He gained so high a reputation under Clement VIII. by the erection of numerous public works, that on the death of that pontiff, and the accession of Paul V. in 1605, he was appointed to finish the building of St. Peter's, being chosen in preference to eight other candidates for the undertaking. The pontificial palace on the Quirinal mount was improved and repaired under his direction, and the fine fluted column on a marble pedestal, in the square of St. Maria Maggiore, was raised by him from the prostrate ruins of the Temple of Peace, and placed where it now stands. Most of the great public works undertaken in his time, in Italy, France, and Spain, were in part under his direction; and the splendid palace of Urban VIII. was begun, but not finished, by him. During his public career he witnessed a succession of ten popes, by all of whom he was regarded with favour. He died in 1629, at the age of 73.

Madrier, a term applicable to flat beams of wood, placed at the bottom of a moat, to support a wall; to a thick plank armed with plates of iron, projected from a petard against the gate, or any other part of a fortified place, to make a breach; a plank of wood covered with tin and earth, for a defence against fire, is also called a madrier.

Maeniana, seats in the upper porticoes of the forum, whence the spectators beheld the performance of the gladiators.

Magazine, Powder. Gunpowder is a store requiring peculiar attention and care, and is either deposited in fortified places, found in towns requiring military protection, or magazines are constructed and particularly adapted for the safe custody of this combustible article. These erections require to be of great strength, and fire-proof. The Gothic arch was therefore adopted; but the proportions of these were believed to be too weak, and modern architects have built the arches of powder magazines of a semicircular form, in the proportions of 60 feet in length and 25 broad; within the foundation wall 8 or 9 feet thick, and from the foundation to the spring of the arch, 8 feet; the floor raised two feet above the ground, and well protected from moisture; and the store room six feet high to the floor of the arch. The arch is formed of four arches, one above another, and the top of the building formed of solid workmanship, rising out of the arch. The gable ends are four feet thick, and their foundations five; the sides are supported by four counterforts; between which there are air-holes, to ventulate and keep the room dry.

Mahogany, a wood sometimes used for doors and window sashes, is seasoned by sawing out and drying in the open air, after exposing to the weather during the winter: it ought never to be exposed to fire-drying. It was some time early in the last century, that this beautiful wood was first introduced into this country. The Jamaica mahogany is the hardest and most beautiful, and distinguished from that of Honduras, by the chalky appearance of its fibres: those from Honduras appear quite dark; after oiling, this distinction is not so clearly observable. See *Joinery*.

Main Couple, see *Couple*.

Maison Angelique, see *Aqueduct*.

Maison Carree, (Fr.) an ancient edifice at Nismes, of a long square form, which is one of the finest specimens of Roman architecture and sculpture found in France. It is twelve toises long, including the vestibule, and the interior is eight toises long, six wide, and six high. The entrance is on the north. The walls are two feet thick, and composed of fine white stones. It has thirty fluted pillars of the Corinthian order, with attic bases, the mouldings of the base are round, and delicately worked. A rose occupies the whole height of the abacus, which is also charged with other ornaments. The architrave has three great bands, the frieze is covered with sculptured foliage, and the cornice is enriched with fine sculptures. The vestibule is open on three sides, and is supported by ten columns, six of which are in front. The front on the tympanum, which surmounts the vestibule, is without ornaments; those of the frieze and architrave are gone; but the cramps in one or two places are still visible, which have served to fasten the letters of bronze, that once formed an inscription. Traces which remain seem to indicate that the vestibule had gates of bronze. The floor of the vestibule, and of the interior, is elevated five feet above the ground, and the entrance is approached by a flight of twelve steps. Under the vestibule is a vault. Architects who have examined this edifice, have discovered some faults and irregularities, such as the unequal number of the modillions, which moreover do not answer to the capitals, except those of the four columns at the angles. Every circumstance connected with this building, prove that it has been a temple, although some have supposed it to be a capitol, and others a prætorium. M. Séguier has been enabled to decipher the following inscription: C. CÆSARI AUGUSTI FILIO CONSULI, LUCIO CÆSARI

AUGUSTI FILIO CONSULI DESIGNATO PRINCIPIBUS JUVENTUTIS. It must, therefore, have been erected about the year of Rome 754, or the first year of the Christian era. The best and most detailed engravings of this building are those by *Clerisseau*, in the first cahier of his Antiquités de la France.

Mallet, (*malleus*, Latin) a wooden hammer used by carpenters, &c.

Maltha, (*μαλθα*, Gr.) originally a native bitumen, with which the ancients plastered their walls. An artificial kind was made of pitch, wax, plaster, and grease; another sort was composed of lime slacked with wine, and incorporated with melted pitch and fresh figs.

Mansart, Francis, born at Paris, in 1598, was the son of the king's carpenter, and received his education as an architect from the celebrated Gautier. Possessed of taste and genius, he attained great professional eminence, and was so anxious to produce perfect works, that the discovery of even a trifling deficiency in what he had done, was a sufficient inducement to him to demolish works of considerable magnitude. The fine abbey of Val-de-Grace was begun and nearly completed by him, for the foundress Anne of Austria; but he was arrested in his attempt to demolish part of his work, and others finished what he had begun. President Longueil employed him in the building of the château des Maisons, not far from St. Germain's; and when he had made considerable progress in this work, he pulled it down again, without consulting his employer. But he afterwards finished it in a style of excellence, which gave it the character of the most perfect architectural work of the age. The portal of the Minims in the Place Royale, was his last work. He died at the age of 69, in the year 1666.

Mansard Roof, see *Curb Roof*.

Mansion, (Lat.) a large house. The origin of the term, and application, is believed to have come from the *mansiones*, or *stationary camps*, of the Roman soldiers, see *Castra:* and on the subject of mansions, see *House*. The French *maison*, a house, comes from the same origin.

Mantel Tree, or *Mantel-Piece*, the name given to the beam of wood supporting the breastwork of a chimney. In modern building its place is supplied by an iron bar, or by an arch of brick or stone.

Mantlets, in fortification, a kind of moveable pent-houses, made of pieces of timber sawed into planks about three inches thick, nailed over one another to the height of six feet, cased with tin, and set on wheels, to be driven before the pioneers or miners in a siege, to conceal them from the enemies' shot.

Maple, (*acer campestre*,) a very common tree in almost every part of Great Britain. The timber of the common maples is far superior to the beech for all the uses of the turner; and when it abounds with knots, as it frequently does, it is much esteemed by joiners for inlaying. It is frequently employed for making musical instruments, on account of its lightness. It is of the same genus of plants as the sycamore, or *acer pseudo-platanus*. See *Sycamore*.

Marble, (*marbre*, Fr. *marmor*, Lat. from *μαρμαρον*, Gr. *a shining stone*,) a peculiar kind of stone, of a hard and compact texture, and a very fine grain. Its varieties are almost innumerable. It is formed in beds or strata in most of the mountainous countries of Europe. In England it is most abundant in Derbyshire. That of Italy is, however, the most valuable of any, particularly the black and milk-white marble found at Carara, in the duchy of Massa. Goguet thinks, that in Homer's time marble was unknown in Greece, but Millin and others think, that the Greeks of the Homeric age not only knew the nature of marble, but also the art of polishing and working in it; but this writer thinks the only marble known by Homer, or perhaps the only stone to which the name was given, was the brilliant white marble, *marmor salinum*. Workmen in marble, among the Greeks, were called *lithotomoi*, *lithokopoi*, *lithourgoi*, &c. among the Romans, *marmorarii*: their business was to take it out of the quarries, to saw it, and to polish it. From inscriptions that remain, it appears that they formed a kind of society, *sodalitium*, who had their patrons, schools, privileges, and gods, which were Minerva and Vulcan. The authors who treat of the marbles of the ancients, are Ernesti, Winckelmann, de Launay, "Minéralogie des Anciens," and Caryophilus, "De Marmoribus Antiquis."

Amongst the most valuable marbles of antiquity, we must first enumerate the white marble of mount Penteles in Attica, thence called *Pentelican marble*. It was used in the Parthenon and other buildings of Athens, and it was in great repute among the sculptors. The isle of Paros has always been celebrated for its marble. The finest *Parian marble* was that excavated in mount Marpessus, and thence called *Marpessian marble*. The marble of Paros was sometimes termed *lychneus*, because used in making candelabra; and *Lygdinum*, from the promontory of Lygdos. Another of the white marbles of antiquity was that of mount *Hymettus* in Attica. The white marbles of *Thasus* and *Lesbos* were also in great repute. The latter isle produced also a black marble. A marble even whiter than that of Paros was discovered at *Luna* in Etruria. Amongst the white marbles, we may also mention the *marmor Phellense*, from mount Phelleus; the *marmor Coraliticum*, found near the river Coralios in Phrygia, and termed also *Sangarium*, from another name of the same river; the *Cyzicum marmor* was taken from the quarries of Cyzicus in Asia Minor; the *marmor Synnadicum*, or *marmor Phrygium*, was found in the environs of the city of Synnada in Phrygia, and was of a black ground with little circles. Another sort of marble, which resembled ivory in its colour, was called *Chernites*. Among the black marbles, that of *Tænarus* was in great esteem; the *marmor Libycum*, or *Numidian marble*, called also *marmor Luculleum*, was what the French term *noir antique*, or *rouge antique*. The celebrated *Chium marmor*, [illegible] excavated from the mount [illegible]us, in the isle of Chio, and was of a transparent chequered black colour. The *marmor Obsidianum* was also black, and was procured from Ethiopia. The isle of Proconesus produced a black veined marble, called *Proconesian*, or *Cyzican marble*. The marble of mount Taygetes, called *marmor Laconicum*, was of a green colour, and is known among antiquaries by the name of *verde antique*. The *marble of Carystus*, was a mingled green; that of mount Atrax, in Thessaly, called *Atra-*

cium *marmor*, was a mixture of white, green, blue, and black. The green *Tiberian* and *Augustan* marbles were found in Egypt. The *marmor Aphites*, or *Memphites*, which took its first name from its resemblance to the colour of the skin of a serpent, and its other from the city of Memphis where it was found, is called now in Italia *il serpentino antico*. The *marmor Synnadicum*, which was also termed *Phrygian*, and *Mygdonian*, was black and red, and was found at Synnas, in Phrygia. The *Corinthian marble* was yellow: the *marmor Phengites*, which was found in Cappadocia, was white with yellow spots: the *Rhodian marble*, was marked with spots resembling gold: the *marble of Melos*, excavated in mount Acynthus, was also yellow.

The varieties of marble used in modern times, are exceedingly numerous, and a classification of them would occupy a larger space than can be allowed for this article. Except the finest specimens of white marble, they are all opake, some exquisitely fine specimens of white marble are to be seen in the Borghese palace at Rome, which on being suspended by the centre, resting on a hard body, bend very considerably; and it is found that statuary marble exposed to the sun, in time acquires this property, indicating a less degree of adhesion of its parts, than it naturally possessed. The ancients were supplied with marble from quarries, which are at present almost entirely unknown; of these marbles exquisite specimens are preserved in the Musée Napoleon. Almost every mountainous part of the world produces this mineral, but the finest and most valuable is from Italy. The British marbles from Derbyshire, Devonshire, Anglesea, and Kilkenny are well known.

Marble, *Polishing of*, was well understood by the ancients, and performed differently in different countries. It is first brought to an even face, by rubbing with freestone; afterwards with pumice stone; and lastly, emery, if of several colours; but white marble is finished with calcined tin. The Italians polish with lead and emery. The process of polishing practised in the manufactory of Messrs. Brown and Mawe, at Derby, is said to be as perfect as any in the kingdom; and accelerated by numerous improvements in the mode of operation. Several kinds of sand are used, from the sharpest sand to the finest that can be procured; after which emery, of various degrees of fineness; and then the substance called tripoli, which owes its red colour, and polishing power, to the oxide of iron it contains. This smooth powder leaves a good polish on the face of the marble; but the application of putty, or oxide of tin, gives a superior brilliancy to the work. Finely levigated ironstone may be used with effect, instead of tripoli. An iron plate is used for rubbing the sand upon the marble, in the commencement of the process: an alloy of tin and lead is applied to the stratum of emery, and a coarse linen cloth fixed to an iron plate, is used with the putty in the last part of the process. A graduated supply of water is necessary in these operations. The sawing of marble preparatory to polishing is by a saw of soft iron, with a continued supply of the sharpest sand, and water.

Marcia Aqua, one of the aqueducts of ancient Rome.

Market, see *Agora*.

Market Cross, see *Cross*.

Marmorarii, (Lat.) workers in marble. See *Marble*.

Marmoratum. (Lat.) a plaster of pounded marble, or mortar of lime and marble beaten together, mentioned by Varro as employed in walls, terraces, &c.

Marquetry, (Fr.) inlaid work of fine hard pieces of wood of different colours fastened in thin leaves on a ground; called also inlaying. See *Parquetry*.

Masonry, the art of arranging and joining stones together for the formation of walls, in the construction of buildings. Vitruvius mentions seven kinds, distinguished by the different modes of arranging the stones: of these, three are of hewn stones. The reticulated Masonry, consisting of stones squared in their courses, forming a regular appearance with the intersecting lines, parallel, diagonally, and perpendicularly; it is agreeable in appearance, but the weakest mode of masonry.—Bond masonry, is that wherein the stones of each succeeding course are laid, not exactly over those below, but projecting, as tiles of roofs are arranged; so that the joint that mounts and separates two stones always falls directly over the middle of the stone below. The appearance of this work is less beautiful, but more durable, than the net-work masonry.—The mode of laying the stones so that when two stones are laid, each of which makes a course, a third is laid at the end, of the thickness of two courses, and the same order observed throughout the building, may be called double-binding; the binding being not only of stones of the course with one another, but of one course with another.—Masonry by equal courses, called by the ancients *isodomum*, differs in nothing from the bond masonry but in this, that its stones are not hewn.—Masonry by unequal courses, is also made of unhewn stones laid in bond-work, but the courses of unequal thickness.—Masonry filled up in the middle, is likewise made of unhewn stone, and by the ancients called *emplecton*; in this method the stones are only set in order by the courses, the middle being filled up with stones thrown in at random among the mortar.—Compound masonry, is so called, as being made up of all the rest. In this, the courses are of hewn stone, and the middle, being left void, is filled up with mortar and pebbles thrown in together. After this the stones of one course are bound to those of another course by cramp-irons, fastened with melted lead.—All the kinds of masonry in use at present, may be reduced to five. Bond masonry: that of brick-work, where the bodies and projections of the stones enclose square spaces, or panels, &c. set with bricks; that called *de moilon*, or small work, where the courses are equal, well squared, and their edges or beds rusticated; and that wherein the courses are unequal, and filled up in the middle with little stones and mortar.—Further information on the different parts of the practice of masonry, will be found under their different articles; as *Foundation*, *Wall*, &c. As the construction of domes, groins, and circular arches are the most difficult and complicated branches of the art, we have illustrated it by the plates *Masonry*, M. 6, 7. In plate *Masonry*, M. 6, the first figure shows the method of constructing spherical domes. No. 1, is the mould applied on the spherical surface to the vertical joints; and No. 2, the mould on the same surface to the other joints, the mould tending, in both cases, to the centre of the dome; Nos. 3, 4, 5, 6, 7, 8, are moulds that apply to the convex surface to the horizontal joint: the lines *a*, *b*, *c*, *d*, *e*, *f*, &c. being at right angles to the different radii *bc*, *dc*, *fc*, &c. produced until they intersect the perpendicular *ac*, the different intersections being the centres which give the circular leg of the mould, and the straight part that which gives the horizontal part. The second figure is the plan of a ground vault. The arch must be laid down on a floor or piece of floor-cloth, then let the number of joints in the semi-circular arch be divided, and drawn on the plan, and from the intersections with the diagonals draw the transverse joints on the plan, of which we may find the curve by setting the corresponding distances from the line of the base to the curve, as *ab* equal to *ab*; next draw the joints of the elliptic arch in the manner shown at *cd*; that is, draw the chord *ec*, and bisect it, and draw a line from the centre *c* through the bisecting point, and produce it till it touches the perpendicular *ef*, then *cd*, being at right angles to *ef*, will be the required joint: the others may be found in the same manner. On examination, we shall find, that a rectangle circumscribing the mould 3, 3, will give the magnitude of the stone in its square state, and that if each stone in both arches be thus enclosed, the dimensions for each will be found, and the position for the moulds. The third figure on this plate shows the manner of drawing the joints for the stones in an elliptic arch in a wall, &c. The curve is described by the intersection of lines; find the foci F, and since in an ellipsis the distance of either focus from one extremity of the axis minor is equal to the semi-axis major, DF is equal to *c* C; then to find a joint as *ab*, draw lines from both foci through the point *b*, as F *e*, *fd*, and bisect the angle *dbe* by the line *ab*, which will be the joint. In plate M 7, the first figure shows the method of finding the moulds necessary for the contraction of a semicircular arch, cutting a straight wall obliquely. Let A B C D E F G H be the plan of the arch, I K L M the outer line, on the elevation, and N O P Q the inner line; *a b c d e* on the elevation exhibits the bevel of each joint from the face of the wall, and *a b c d e* beneath, gives the mould, *x y* on the elevation, corresponding with *x y* at *a*. The arch mould, No. 2, is applied on the face of the stone, and gives, when applied to the parts of the plan, the bevel of each concave side of the stone with the face, *i. e.* K to O on the elevation. The second figure shows the method of finding the mould for constructing a semicircular arch in a circular wall. No 1 shows the elevation of the arch, and No 2 the plan of the bottom bed from *q* to *r*; *a* to *b* is what the arch gains on the circle from the bottom bed *k* to *l*, and *c* to *d* is the projection of the intrados to *p*, on the joint *lp*. Nos. 2, 3, 4, plans of the three arch stones, Nos. 1, 2, 3, in the elevation; Nos. 5, 6, moulds to be applied to the beds of stones, Nos. 1, 2, where *sc* is equal to *sc* in No. 2, and *tw* to *tw* in No. 3; *k l p o* in No 1, is the arch or face-mould.

MASONRY, FREE. The strange oblivion attending the introduction of the Pointed, or English style of architecture, is in some measure explained by a consideration of the character and circumstances of the persons engaged in erecting buildings during the centuries in which it flourished. It would appear that associations of architects and workmen had been long in the habit of traversing various countries, for the purpose of undertaking the construction of ecclesiastical edifices, according to the most approved method of each prevalent style, or fashion. These associated parties of masons met with peculiar favour from the pope, towards the close of the twelfth century. "Bands of architects and artists," of various nations, were then incorporated by the holy father, and were endowed with many great and exclusive privileges. Among the advantages obtained by them at that time, was an authoritative grant of permission to fix their own prices of labour, subject, perhaps, to some regulations enacted in the papal chapter. This arbitary privilege, which exempted such artists from the operation of the statutes of labourers prevailing in England, remained in force until the reign of Henry the Sixth; but it will appear, that they assumed little on so comprehensive an indulgence, and were as moderate in demands for compensation, as they were transcendent in professional skill. The persons thus incorporated, and stimulated to exertions by such valuable endowments, were termed, in England, "Free and accepted Masons." Many important particulars respecting this fraternity are transmitted by Christopher Wren, who was the grand master and ruling genius of that wreck, or mimicry of the institution, which existed in his time; and he was a man likely, from professional curiosity, to examine all its remaining records. After noticing the indulgence granted to these builders by the pope, he observes, that they styled themselves free masons, and ranged from one nation to another, as they found churches to build, (for very many in those ages were every where building, through piety or emulation.) Their government was regular, and where they fixed near the building in hand, they made a camp of huts. A surveyor governed in chief; every tenth man was called a warden, and overlooked each nine; the gentlemen of the neighbourhood, either out of charity, or commutation of penance, gave the materials and carriages. Those who have seen the exact accounts in records, of the charge of the fabrics of some of our cathedrals, near four hundred years old, cannot but have a great esteem for their economy, and admire how soon they erected such lofty structures. "Indeed, great height they thought the greatest magnificence; few stones were used but what a man might carry up a ladder, on his back, from scaffold to scaffold, though they had pulleys and spoked wheels upon occasion; but, having rejected cornices, they had no need of great engines; stone upon stone was easily piled up to great heights; therefore, the pride of their works was in pinnacles and steeples. In this they essentially differed from the Roman mode, which laid all the mouldings horizontally, in order to make the best perspective; and they made their pillars of a bundle of little toruses, which divided when they came to the roof; and then these toruses split into many smaller ones; and, traversing one another, gave occasion to the tracery work (as it is called) *of which this society were the inventors.* They used the sharp-pointed arch, which would rise with little centreing, required lighter key-stones, and less butment, and yet would bear another row of double arches, rising from the key-stone; by diversifying of which, they erected structures of eminence, such as the steeples of

Vienna, Strasburg, and others in different countries. In different parts of the Parentalia of Sir Christopher Wren, it appears that the practice of the pointed arch exclusively belonged to the fraternity of the free masons. And the inference thus arising, is the chief article of information which he conveys. His distaste towards the attractive style used by this skilful association, is sufficiently known. It would appear that he could not fathom the rules of art by which their works were governed, and politically affected to despise that which he wanted invention to imitate. To a contemptuous neglect of inquiry, or to an affectation still more reprehensible, must be attributed the excursive spirit which led him to Vienna and Strasburg, when he might have found finer examples on English ground, executed by English artists. While we recollect that the cultivation of the pointed style appears to have been exclusively confined to the fraternity of free masons, we shall be less surprised at the mystery in which the early history of this beautiful order of architecture is involved. The associated architects and artificers, so denominated, naturally made a secret of those rules of art which produced a lucrative monopoly. And such an intention was carried into effect with comparative ease, in unlettered ages, when war was the great employment of the chieftain, and of his adherents throughout nearly all the classes of the laity. The same spirit has been evinced in more recent ages, in regard to the cultivation of the arts; and has been rendered futile only by the enterprising and commercial temper of an advanced state of society. The mysterious and secret practices of the free and accepted masons, have descended, by tradition, to their united representatives of the present day, and are wrought into a proverb by the vulgar. That they possessed written documents illustrative of those principles of art by which they produced architectural effects so consistent and impressive, will scarcely be denied. Intent on a love of privacy, and indignant at the neglect into which their science was fallen, it is probable that many of these documents were destroyed by the masons, on the revival of Grecian architecture. We are distinctly told by Preston, that " many of the fraternity's records, of the time of Charles the Second, and succeeding reigns, were lost at the Revolution; and that not a few were too hastily burnt, at a later date, by some scrupulous brothers, from a fear of making discoveries prejudicial to masonry. The import of these writings is involved, perhaps for ever, in that profound obscurity so much cherished by the association. It is probable, however, that they contained little or no intelligence respecting those valuable secrets of art which were once so profitable to the brethren, and concerning which we now inquire with such earnest and rational solicitude. That no illustrative papers remained to the time of Sir Christopher Wren, is evident from his silence; and is still more apparent, from the absurdities into which he fell, when he attempted to imitate the works of his " accepted" predecessors.

Mathematical Instruments. See *Instruments*.

Mathematics, (Gr.) may be defined as the science of quantity, or that science which considers magnitudes as computable or measurable. The mathematical sciences are divided into *pure* or *speculative*, which are those that consider matter abstractly, and *mixed;* the latter treating of magnitude as subsisting in material body, and combined with physical considerations. The mixed mathematics are very comprehensive, including astronomy, optics, geography, hydrostatics, mechanics, fortification, navigation, &c.

Mauresque, the style of building peculiar to the Moors and Arabs. See *Arabian Architecture.*

Mausoleum, (μαυσωλειον, Gr.) a building erected by his wife to the memory of Mausolus, king of Caria, whence the term was afterwards applied to every sumptuous sepulchral monument. An essay on this monument is given by *Caylus,* in the 26th volume of the Memoires de l'Académie des Belles Lettres, and a treatise by *Aulisius,* De Mausolei Architecturâ, will be found in the third volume of the Thesaurus of *Salengre.* The Adrianeium, or Mausauleum of Adrian, is one of the most remarkable monuments with which that emperor embellished the city of Rome. It was situated near the Tiber, and there are considerable remains, which have in modern times been turned into a fort, known by the name of the Castle of St. Angelo. The lower part is a great square, each side of which is about one hundred and forty-eight ells long, and thirty-four high. Above this square rises a round building, anciently surrounded by a gallery of Corinthian columns. The diameter of this circular building, including the peristyle, was one hundred and nineteen ells; the height of the columns, including the architrave, was twenty-four ells. Probably this circular building was surmounted by another of a similar form, also surrounded by columns. The entire edifice was coated with white marble, adorned with a great number of statues, and surmounted by a quadriga with a statne of Adrian. This edifice communicated with the city by a bridge over the Tiber, which was no less magnificent than the building itself. It is three hundred feet long, and has five arches. Anciently it was called the Ælian Bridge, now it is called the bridge of St. Angelo.

Measure, (*mensura,* Lat. μετρον, Gr.) that which serves to determine the extent of any quantity. The *measure of an angle* is an arc described upon the angular point; in *fig.* 12, *pl.* M. 1, the arc ADB is the measure of the angle ACB. The *measure of a plane figure* or *superficies,* is a square of 1 foot, inch, &c. The *measure of a number,* is a number of which it is a multiple, as 2 is the measure of 4. The *measure of a ratio,* is a logarithm. The *measure of a solid,* is a cube of 1 inch, &c. The *measure of a line,* is any right line taken at pleasure, and considered as unity. The *measure of velocity,* in mechanics, is the space passed over by a moving body in any given time; to measure a velocity, the space must therefore be divided into as many equal parts as the time is conceived to be divided into: the quantity of space in such intervals is the measure of the velocity.

Measure *of the mass or quantity of matter,* is only to be ascertained by its gravity or weight, the same bulk of an homogeneous body being of the same weight, whatsoever its form may be.

Mechanical Carpentry, that branch of Carpentry which teaches the disposition of the timbers according to their relative strength, and the strains to which they are subjected. Timber in building, &c. is exposed to four strains—(1) a piece may be torn asunder—(2) crushed—(3) broken across—(4) or wrenched or twisted. The first may happen to tie-beams, king-posts, stretchers, &c. the second to pillars and truss-beams; the third to a joist or lever; and the fourth to the axle of a wheel, the nail of a press, &c. The first of these strains is the most simple, and the others are all modifications of it. It has generally been agreed, but it is denied by Buffon, that the heart of the tree is the weakest part, and that this weakness increases with its age. The middle of the trunk is stronger than at the root, or at the springing of the branches, or the branches themselves, and the outer fibres, which are termed the *blea*, are weaker than the rest. In European trees, the wood on the northern side is the weakest, and that on the south side, the strongest; and it is always observed that the heart of the tree is nearest the north side, where also the annual plates are considerably thinner than on the south. Muschenbroëk made a number of experiments on the absolute strength of different woods, with pieces cut in slips, one part being cut away to a parallelopipedon one-fifth of an inch square, and the twenty-fifth part of a square inch in section. The following are the results of his experiments; the number of pounds giving the absolute strength of a square inch.

	Pounds.
Locust Tree, (Acacia.)	20100
Jubeb	18500
Beech and Oak	17300
Orange	15500
Alder	13900
Elm	13200
Mulberry and Willow	12500
Ash	12000
Plum	11800
Elder	10000
Pomegranate	9750
Lemon	9250
Tamarind	8750
Fir	8330
Walnut	8130
Pitch pine	7650
Quince	6750
Cypress	6000
Poplar	6500
Cedar	4880

These numbers are given as the weights will just tear them asunder. To this table of the strength of wood we may add—

	Pounds.
Ivory	16270
Horn	8750
Whalebone	7500
Bone	5250
Tooth of the Sea-calf	4075

It may be observed, however, that two-thirds of these weights will greatly impair the strength after a considerable time, and in general one half is the utmost that ought to be reckoned upon, as more may risk their ultimate demolition. Woods of very straight fibre, such as fir, will suffer less injury from a load which is not sufficient to break them immediately. Muschenbroëk's tables assign a much greater tenacity to the different woods than the generality of writers who have treated on the subject; the reason however is, that he gives the weight that will just tear them asunder, while others give that which may be suspended to them with safety. He gives a very minute detail of his experiments on the ash and walnut, and the result as given in the table on these woods may be considered as the average of more than fifty trials on slips from each side of the tree, from the centre to the circumference.

Mr. Emerson lays down as a rule, that a cylinder of any of the following substances, of six inches diameter, when loaded to one-fourth of its absolute strength, will carry—

	Cwt.		Cwt.
Iron	135	Good Rope	22
Oak	14	Fir	9

From Emerson's experiments it appears that the following weights may be safely suspended to an inch square of the different bodies enumerated.

	Pounds.
Iron	76400
Brass	35600
Hempen Rope	19600
Ivory	15703
Oak, Box, Yew, Plum-tree	7850
Elm. Ash, Beech	6070
Walnut	5360
Red Fir, Holly, Elder, Plane, Crab	5000
Cherry, Hazel	4760
Alder, Ash, Birch, Willow	4290
Freestone	914
Lead	430

We calculate, in theory, that the positive strength of a body suffering under compression, will sustain a weight in relative proportion to the area of its section. But as a piece of timber cannot be so straight, and the weight acting upon it so equally disposed, that it will press in a direction precisely perpendicular upon each fibre, the weight must be regulated in some measure by its length. From the observations of Parent, it appears that the force required to crush a body, is in general nearly equal to that which will tear it asunder, and that it requires something more than sixty pounds on every square line, to crush a piece of sound oak. But Parent's rule is not applicable in every case, as woods of a soft texture are much more easily crushed in proportion to their tenacity than others. Euler published first in the Berlin Memoirs for 1757, and confirmed in the Petersburg Commentaries for 1778, his theory, that the strength of prismatic columns is in the direct quadruplicate ratio of their diameters, and the inverse ratio of their lengths.

One of the most common strains to which bodies are exposed, is that which tends to break them across, in which case it frequently happens, that in addition to the positive force of the strain, the power of a lever is exerted. This will be better explained by the diagram (plate *Athenian Architecture* A 9, *fig*. 2) in which ABC is the vertical section of a prismatic solid, that projects horizontally from a wall in which it is firmly fixed; let a weight be hung on it at B, or any power act there in a direction perpendicular to AB, and let the body be supposed to possess insuperable strength in every part but the vertical section DA, perpendicular to its length, in which place only it must break. Let the cohesion be uniform through the whole of this section; that is, let each of the adjoining particles of the two parts cohere with an equal force. *f*, the part ABCD, may simply slide down along the surface of the fracture, if the power acting at B be equal to the accumulated force which is exerted by every particle composing the section in the direction AD. Let this be prevented by something supporting the point A, then the action at P tends to make the body turn round A in the same manner as round a joint, in which case it must separate at the line DA, when the adjoining particles at D, or at E, will be separated horizontally. Since, however, their attraction of cohesion resists this separation, in order that the fracture may happen at the place intended, the energy of the power P, acting by the lever AB, must be superior to the accumulated energies of the component particles: and the energy of each depends not only on its cohesive, but also on its peculiar situation, since the supposed insuperable firmness of the rest of the body renders it a lever, turning round the fulcrum A; the individual cohesive power of each particle, as D or E, acting by means of the arm DA or EA.

Consequently, the precise energy of each particle may be ascertained by multiplying the force individually exerted by it, at the moment of fracture, by the arm of the lever which enables it to act. Let $f^{\backprime}$ represent the equal force exerted by each individual particle at the moment of fracture: the energy of D will be DA $\times f^{\backprime}$, that of E will be EA $\times f^{\backprime}$, and that of the whole will be the sum of all these products. Let d represent the depth of the section DA, and let x represent any undetermined part of it, as AE, then the space occupied by any particle will be $x^{\backprime}$. The cohesion of this space may be represented by $f^{\backprime} x^{\backprime}$, and that of the whole by $f^{\backprime} d$. $f^{\backprime} x x^{\backprime}$ will represent the energy by which each element $x^{\backprime}$ of the line DA, or d, resists the fracture, and the whole accumulated energies will be $f^{\backprime} \times x f x x^{\backprime}$. This is $f^{\backprime} \times \frac{1}{2} d^2$, or $f^{\backprime} d \times \frac{1}{2} d$, which is the same thing as if the cohesion $f^{\backprime} d$ of the whole section had been concentred at the point G, which is in the middle of DA.

Buffon and Du Hamel were directed by the French government to make a variety of experiments on the strength of timber, and were furnished with ample funds and apparatus, with all the forests of France at their disposal, for subjects. The reports of M. de Buffon are given in the Memoirs of the French Academy in the years 1740, 1741, 1742, and 1760, and those of M. Du Hamel in his work, "Sur l'Exploitation des Arbres, et sur le Conservation et la Transportation du Bois." Du Hamel took sixteen bars of willow, two feet long, and half an inch square, and after supporting them by props under the ends, he suspended weights to the middle, and found that four of them were broken by forty, forty-one, forty-seven, and fifty-two pounds, of which the mean is forty-five. When he cut through one-third of four of them on the upper side, and filled up the cuts by pieces of harder wood wedged in tolerably tight, he found they were broken by forty-eight, fifty-four, fifty, and fifty-two pounds, of which the mean is fifty-one. Four others, when cut through one half, were broken by forty-seven, forty-nine, fifty, and fifty-six pounds, of which the mean is forty-eight. The others were cut through two-thirds: and their mean strength was forty-two pounds. At another time he found that six battens of willow, thirty-six inches long, and one and a half square, were broken on an average by five hundred and twenty-five pounds: that when cut through one-third, they were broken by five hundred and fifty-one pounds; when cut half through, by five hundred and forty-two; when cut three-fourths through, by five hundred and thirty pounds at a medium. The result of his experiments on oak is exhibited in the following table, when three pieces of each dimension were tried. The column B contains the breadth of the pieces in inches, D the depth, L the length, P the number of pounds which broke each piece, and M the mean weight

	B	D	L	P	M
Exp. 1. ends loose.	1	1	18	400 415 405	406
Exp. 2. ends firmly fixed.	1	1	18	600 600 624	608
Exp. 3. ends loose.	2	1	18	810 795 812	805
Exp. 4. ends loose.	1	2	18	1570 1580 1590	1580

Table continued.

	B	D	L	P	M
Exp. 5. ends loose.	1	1	36	185 195 180	187
Exp. 6. ends fixed.	1	1	36	285 280 285	283
Exp. 7. ends loose.	2	2	36	1550 1620 1585	1585
Exp. 8. ends loose.	1⅔	2⅓	36	1665 1675 1640	1660

From this table it appears that (from Exp. 1 and 3,) the strength is proportional to the breadth, the length and depth being the same; that (Exp. 1 and 4) the strength is nearly as the square of the depth, the breadth and length being the same; that (1 and 5) the strength is nearly as the lengths inversely, the breadth and depth being the same; and that (1 and 7) the strengths are as the square of the depth, multiplied by the breadth, and divided by the length. The cause of the irregularity always observed in such experiments, is the texture of the timber.

M. Buffon, tried a number of experiments on the strength of oak, with the largest beams he could possibly break. The following is the result of his experiments on bars of sound oak four-inch square, and free from knots. The first column is the length of the bar between the supports in clear feet: the second, the weight of the bar in pounds, on the second day after it was felled, tried on two bars of each sort: the third, the number of pounds required to break the tree in a few minutes: the fourth, the number of inches in which a tree bends down before breaking: and the fifth, the time at which it broke.

	2	3	4	5
7	60 56	5350 5275	3·5 4·5	29 22
8	68 68	4600 4500	3·75 4·7	15 13
9	77 71	4100 3950	4·85 5·5	14 12
10	84 82	3625 3600	5 83 6·5	15 15
12	100 98	3050 2925	7 8	

M. Buffon, found the cuts next the root both the heaviest and the strongest. He made similar experiments on other pieces of different sizes. The beams were all square. In the following table, the first column gives their length, and at the head of the others are expressed their sizes in inches.

	4	5	6	7	8	A
7	5312	11525	18950	32200	47649	11525
8	4550	9787	15525	26150	39750	10085
9	4025	8308	13150	22350	32800	8964
10	3612	7125	11250	19475	27750	8068
12	2987	6075	9100	16175	23450	6723
14		5300	7475	13225	19775	5763
16		4350	6362	11000	16375	5042
18		3700	5562	9245	13200	4482
20		3225	4950	8375	11487	4034
22		2975				3667
24		2162				3362
28		1775				2881

On the strength of other kinds of timber no experiments have been made. Fir possesses, according to Buffon, three-fifths; according to Parent, five-sixths; or, according to Emerson, two-thirds the strength of oak.

Axles of wheels are the principal objects which are liable to be twisted or wrenched, but they scarcely come within our limits. When two cylinders are wrenched asunder, we must of necessity conclude, that the external particles of each are placed beyond their limits of cohesion, that they are extended and operate equally; hence, at the instant of fracture, the entire sum of the forces actually exerted, is as the squares of the diameters.

Mr. John Banks, in his treatise on the "Power of Machines," has given some valuable observations on the subject of the strength of timber. "The resistance of which any beam of wood or iron affords," he observes, "will be as the sum of the products of all the fibres, between the top and the bottom, multiplied by their respective distances from the top. For if $a =$ length, $b =$ breadth, and $z =$ depth, we shall have $z \times z$, and divided by $\frac{a}{2}$; the fluent of $z z = \frac{z^2}{2}$; hence, $\frac{bz^2}{2} =$ the whole resistance, which when the weight is suspended from the middle of the beam, must be divided by half the length, or by $\frac{a}{2}$, which will be $=$ to $\frac{bz^2}{a}$; which expresses the strength of the beam." Hence he deduces the rule: "Multiply the breadth in inches by the square of the depth in inches, and divide that product by the length in inches, the quotient is a fraction, or whole number, &c. by which is expressed the comparative strength of the beam."

Meckias, or *Mégyas*, (Arabic) an Arabic term which signifies an instrument to measure with, and by which they more particularly designated the *Nilometer* at the southern extremity of Roudhah.

Medallion, any circular tablet on which are embossed figures or bustos.

Medianos, the middle columns in a portico, where the intercolumniation is enlarged.

Mediæval Architecture, the architecture of England, France, Germany, &c. during the middle ages, including the Norman and early Gothic styles.

Megalographia, (Gr.) a name applied by Vitruvius to a kind of painting, representing the history of the gods and heroes, which the ancients employed for the interior ornament of their houses.

Meidan, see *Constantinople*.

Melrose Abbey, a ruin, in the parish of Melrose, in Roxburghshire, in Scotland, and one of the most remarkable in that country. Venerable Bede gives an account of the original abbey, and of its abbots. It is said to have been built in the sixth century. The last erection was founded by king David, in the year 1136. Vestiges of the older abbey may yet be seen at the place called Old Melrose; the foundation stretches across a kind of promontory enclosed by a curvature of the Tweed. Several erections have been since built, which have been successively destroyed, and the present remains belong to a building erected in the time of king Robert Bruce. It has evidently been a spacious and magnificent structure, hardly exceeded by any of the ancient monastic buildings in Great Britain. What remains of this building, are the ruins of the church, which was built in the form of St. John's cross, and the patron saint was the Virgin Mary. These ruins measure two hundred and fifty-eight feet in length, and one hundred and thirty-seven and a half in breadth, and it is nine hundred and forty-three feet in circumference. Its original extent was far more considerable, as is evident, from the appearance of the western part. Formerly, both the internal and outward walls were covered with sculptures of men and animals, but these were destroyed by the violence of the Reformation, in the reigns of Henry VIII., Edward VI. and Elizabeth. The tower which rose from the middle of the transept, was a structure of great beauty and magnificence, as may be clearly inferred from what remains. The great eastern window consists of four mullions, with beautiful tracery. Several elegant niches remain on each side; and on the top is the figure of a venerable old man holding a globe in his hand, and also the figure of a young man, both in a sitting posture, with an open crown over their heads. Many of the pillars remain in a perfect state, the embellishments beautiful, and as fresh in appearance as if newly executed. Besides the church, some of the walls of the cloisters remain; the original buildings, with gardens and other appendages, occupied a space enclosed by a wall of more than a mile in circuit.

MEMBERS, (*membrum*, Lat.) the different parts of a building; the different parts of an entablature; the different mouldings of a cornice, &c.

MEMEL TIMBER, imported from the town of that name, in Prussia. It is situated on the northern extremity of the Cruische-Haf, an inlet of the sea, and its greatest trade is in timber, an immense quantity of which is brought to this country.

MEMNONIUM, (Gr.) a grand building which encircled the celebrated statue of Memnon, in Egypt.

MENAGERIE, (Fr.) a building to keep rare and foreign animals in. The ancient Romans had generally private menageries, a kind of small parks, in which they had all kinds of animals, attached to their villas.

MENSURATION, the science which teaches us to estimate the magnitudes of bodies, superficies, and lines. The most important parts of it will in general be found under their different articles.

MERLON, in fortification, the part of a parapet which terminates by two embrasures of a battery: its height and thickness is usually the same as the parapet; its breadth about six feet on the outside, and nine within; it serves to cover those on the battery from the enemy's attacks.

MEROS, (Gr.) a triglyph consists of six parts, two and a half of which are on each side, and the *meros* is in the centre, and constitutes one part.

MESAULÆ, (Gr.) described by Vitruvius as *itinera*, or passages; they were, however, smaller courts. They are mentioned by Apollonius Rhodius, who, describing the reception of the Argonauts in the palace of Æetes, conducts them first into the vestibule, then through the folding gates into the *mesaula*, which had *thalami* here and there, and a portico, αιθουσα, on every side.

META, (Lat.) the mark or goal in the Roman circus, where the chariots, &c. run to. See *Circus*.

METAGENES, a Grecian architect, who with his father Ctesiphontes, assisted in the erection of the temple of Diana at Ephesus. He wrote a description of that celebrated building.

METATOME, (Lat.) the same as *Metoche*.

METEZAN, CLEMENT, architect to Louis XIII. celebrated for undertaking and completing the immense dyke and fortifications necessary to the reduction of Rochelle, the plan was an imitation of the famous works of Cæsar at Durazzo, and those of Alexander the Great at Tyre. In this undertaking it was necessary to raise a solid wall across a gulf of more than 740 fathoms in breadth, and to do this in the face of an impetuous and boisterous sea. Huge rocks were first thrown into this abyss, in order to form a foundation, and to secure these, immense beams of timber were driven into the bottom of the sea with incredible labour. These works were raised so high, that the soldiers, even at spring-tides, experienced no inconvenience from the rising waves. The platform at the foundation was ninety feet, diminishing, as it rose, to thirty. Strong forts were erected at the extremities of the wall, and an opening in the middle, of one hundred and fifty paces, was guarded by a floating breastwork formed of thirty-five vessels chained together, and before these were a double row of tall stakes. In six months this truly great work was completed, and proved effective in compelling the besieged to surrender. A portrait of Metezan was on this occasion circulated through France, under which the following lines were inscribed, to express the admiration and gratitude of the nation:

> "Dicitur Archimedes Terram potuisse movere;
> Æquora qui potuit sistere, non minor est."

Metoche, (*μετοχη*, Gr.) the intervals between two denticuli in the Ionic entablature.

Metope, (Gr. from *μετα*, *between*, and *οπη*, *a hole*, see *Opæ*,) the space between the triglyphs in the Doric frieze. They were sometimes adorned with carved work, as the heads of oxen, vessels, and other articles used in sacrifices.

Mexican Buildings The remains of ancient Mexican buildings that have been discovered are principally in those parts that were least frequented by the Spanish conquerors. In the city of Mexico, there is scarcely a trace of its former grandeur. The cathedral, a somewhat heterogeneous edifice, is said to stand on the ruins of the great *teocalli* of the god Mexitli. A very credible peroan assured Mr. Humboldt, that the foundations are surrounded by an immense quantity of idols and reliefs. Near the *Capilla del Sagrario*, a sculptured rock was found, seven metres long, six broad, and three in height. Within the enclosure of the cathedral is preserved the remarkable stone called the stone of sacrifices, which was found, with a great number of idols and other remains of Aztec sculpture, in Dec. 1790, in digging twenty or thirty feet deep, in order to level the great square. It is supposed by Humboldt to be one of those stones called *temalacatl*, on which the combat of the gladiators took place, between the prisoners of rank designed to be sacrificed, and a Mexican warrior. At the same time were discovered the calendar stone and the statue of the goddess Teoyaomiqui.

The only remarkable monuments in the valley of Mexico, Mr. Humboldt tells us, are the remains of the two pyramids of San Juan de Teotihuacan, on the north-east of the lake Tezcuco, consecrated to the sun and moon, and called by the Indians *Tonatiuh Ytzaqual*, (house of the sun,) and *Metzli Ytzaqual*, (house of the moon.) Mr. Bullock visited this site on his return from Themascaltepec. For some time before he reaches the gate of Tezcuco, the traveller is apprised of his approach to a place of ancient importance, by a large aqueduct still in use, and the ruins of several stone buildings. The Spanish quarters built for Cortes, are still entire. Several *tumuli* are seen on entering the gates, which are supposed to have been *teocallis*. The most important ruin is what Mr. Bullock calls the site of the palace of the ancient caziques of of Tezcuco, which, though in ruins, far surpassed every idea that he had formed of ancient Mexican architecture. "It extended for 300 feet, forming one side of the great square, and was placed on sloping terraces, raised one above the other by small steps. Some of these terraces are still entire, and are covered with cement, very hard, and equal in beauty to that found in ancient Roman buildings. From what is known of the extensive foundations of this palace, it must have occupied some acres of ground. It was composed of large blocks of basaltic stone, of about four or five feet long, and two and a half or three feet thick, cut and polished with the utmost exactness." The sculptured stones from these ruins have been used in building the modern church and houses. Heaps of ruins surround it on every side, and Tezcuco, the Athens of Anahuac, as it is called by a Spanish historian, would seem to invite, above all others in Mexico, the attention of the antiquary.

At about two leagues from Tezcuco, is a spot called *Bano de Montezuma*, Montezuma's bath, on the summit of a conical hill, called Tescosingo. "We scrambled with great difficulty," observes Mr. Bullock, "through bushes, and over loose stones, which were in great quantities on all sides, and at last perceived that we were on the ruins of a very large building; the cemented stones remaining in some places covered with stucco, and forming walks and terraces, but much encumbered with earth fallen from above, and overgrown with a wood of nopal, which made it difficult to ascend." He discovered the bath on one of the sides of the hill. "It was cut in the solid rock, and standing out like a martin's nest from the side of a house. It is not only an extraordinary bath, but still more extraordinarily placed. It is a beautiful basin, about twelve feet long, by eight wide, having a well about five feet by four deep in the centre, surrounded by a parapet or ruin two feet six inches high, with a throne or chair, such as is represented in ancient pictures to have been used by the kings. There are steps to descend into the basin or bath; the whole cut out of the living porphyry rock with the most mathematical precision, and polished in the most beautiful manner. The mountain appeared to have been covered with palaces, temples, baths, hanging-gardens, &c and Mr. Bullock was informed that he had seen but the commencement of the wonders of the place.

About two miles from Tezcuco, is the Indian village of Huexotla. Mr. Bullock observed, on his approach, several small pyramids of alternate layers of clay and unburnt brick. One of them had evidently an entrance to the centre, which was discovered by part of it having fallen in. Within the town were the foundations of a palace, and two large reservoirs, with which it was supplied with water, remain entire. The ancient wall of the town, almost thirty feet high, and very thick, extends to a considerable distance. It is singularly constructed, being divided into five unequal parts. The broadest division is built of large oval stones, with the ends standing out, so as to give it the appearance of having been formed of human skulls, and it is divided from the rest by a projecting cornice. Beyond the walls, on the road to Tezcuco, a broad covered way runs between two huge walls, terminating near a river, which appears to have been one of the entrances to the town. Over the bed of the river, which is now dry, there is a remarkable bridge, with a pointed arch, nearly forty feet high, supported on one side by a mass of masonry in a pyramidal shape. It is ascribed to the ancient Mexicans, but if constructed on the principle of the arch, it must have been the work of European architects.

Mr. Bullock visited the celebrated pyramids of San Juan de Teotihuacan. "As we approach them," he says, "the square and perfect form of the largest became at every step more and more visibly distinct, and the terraces could now be counted. We rode first to the lesser, which is the most dilapidated of the two, and ascended to the top over masses of fallen stone and ruins of masonry, with less difficulty than we expected. On the summit are the remains of an ancient building, forty-seven feet long and fourteen wide; the walls are principally of unhewn stone, three feet thick and eight feet high; the entrance at the south end, with three windows on each side; and on the north end it appears to have been divided at about a third of its length. We soon arrived at the foot of the largest pyramid, and began to ascend. It was less difficult than we expected, though the whole way up, lime and cement are mixed with fallen stones. The terraces are perfectly visible, particularly the second, which is about thirty-eight feet wide, covered with a coat of red cement eight or ten inches thick, composed of small pebble-stones and lime. In many places, as you ascend, the nopal trees have destroyed the regularity of the steps, but no where injured the general figure of the square, which is as perfect in this respect as the great pyramid of Egypt. We every where observed broken pieces of instruments, like knives, arrow, and spear heads, &c. of obsidian, the same as those found on the small hills of Cholula; and, on reaching the summit, we found a flat surface of considerable size, but which has been much broken and disturbed. On it was probably a temple, or some other building: report says, a statue covered with gold. We rested some time on the summit, enjoying one of the finest prospects imaginable, in which the city of Mexico is included. Here I found fragments of small statues and earthenware, and, what surprised me more, oyster-shells, the first I had seen in Mexico. In descending, I also found some ornamental pieces of earthenware, the pattern one of which is in relief, much resembling those of China, the other has a grotesque human face. On the north-east side, at about half way down, at some remote period, an opening has been attempted. This should have been from the south to the north, and on a level with the ground, or only a few feet above it; as all the remains of similar buildings have been found to have their entrances in that direction." According to the measurements made by Dr. Oteyza, a young Mexican *savant*, in 1803, the base of the larger pyramid is 682 feet long, and its elevation 180 feet perpendicular. Mr. Bullock thinks its height to be nearer half the base. The other pyramid (that of the moon) is 36 feet lower, and its base much smaller. They are constructed of clay mixed with small stones, covered with a thick facing of porous amygdaloid, over which was a coating of cement.

There are four stages, subdivided into smaller steps; a stair of hewn stones formerly led to their summits. Early travellers all mention the prevailing tradition that their interior was hollow. Around them, in the plain, there are several hundred smaller ones, in general about 30 feet high, which, according to the tradition, were dedicated to the stars. It is probable, however, that the whole plain was a vast burial place; its Aztec name was *Micaotl*, i.e. the road of the dead, which the Spaniards, borrowing a word from the language of the island of Cuba, have rendered *Llano de los Cues*. They are supposed to be the most ancient of all the Mexican monuments. The military intrenchment of Xochiculco, near Tetlama, two leagues south-south-west of Cuernavaca, is another remarkable ancient monument. It is an insulated hill, about 370 feet high, formed into five terraces, which are covered with masonry; the whole form a truncated pyramid, of which the four faces accurately correspond, like the pyramids of Hotihuacan, to the four cardinal points. The stones are of very regularly cut porphyry, adorned with hieroglyphical figures, among which are to be seen crocodiles spouting up water, and men sitting crosslegged in the Asiatic manner. The base is surrounded with ditches or trenches, which appears to be the only reason of its being styled by Humboldt a military intrenchment." The platform exhibits the ruins of a small square edifice.

At two leagues' distance from the large village of Papautla, there is a remarkable pyramid, which was first discovered about sixty years ago. Situated in the midst of a thick forest, called Tajui, it was concealed from the first conquerors. It differs from the pyramids of Teotihuacan and Cholula, in being constructed, not of brick or clay, but wholly of immense blocks of stone, very regularly cut, and laid with mortar. The base is an exact square of 80 feet. It is not quite 60 feet high. It is composed of several stages, of which six are yet visible; a seventh is concealed by vegetation. Three flights of 57 steps lead to the truncated summit. The facing is adorned with hieroglyphics, in which are discernible serpents and crocodiles in relief. 378 square niches are symmetrically distributed over the pyramid, which have been conjectured to correspond to the Mexican calendar.

In the northern part of the intendancy of Sonora, on the banks of the Rio Gila, are found some remarkable ruins, which are known by the name of *La Casa grande*. They are considered by the Mexican historians as the abode of the Aztecs on their arrival at the Rio Gila towards the end of the twelfth century. The country is still held by native tribes, and no permanent communication has ever been established. Two enterprising monks, Fathers Garces and Font, however, succeeded in penetrating these districts by land in 1773, of which enterprise the college of the Propaganda published an interesting notice. The edifice called *La Casa grande*, is situated in the midst of the ruins of an ancient Aztec city, which occupy more than a square league. The *Casa grande*, exactly laid down according to the four cardinal points, is 445 feet from north to south, and 276 from east to west. It is constructed of unburnt bricks, of unequal size, but symmetrically arranged. The walls are nearly four feet thick. It had three stories, and a terrace; the stair, probably of wood, was on the outside. We perceive in it five apartments, each of which is about 27 feet long, 10 broad, and 11 high. A wall, interrupted by large towers, surrounds the principal edifice, and appears to have served to defend it. Vestiges of an artificial canal were discovered, which brought the water of the Rio Gila to the town. The surrounding plain is covered with broken earthen pitchers and pots, prettily painted in white, red, and blue. The social civilization of the Indians in the neighbouring plains, forms a singular contrast with the state of the savages who wander about on the banks of the Missouri. They live collectedly in villages, are clothed, and peaceably cultivate the earth. Still further north, in the country of the Moqui, on the *Rio de Yaquesila*, in lat. 36°, Father Garces was astonished to find an Indian town with two great squares, houses of several stories, and streets well laid out in parallel directions. The edifices were constructed exactly in the same manner as the *casas grandes* on the banks of the Gila river. Every evening the people assemble together on the terraces which form the roofs. "Every thing in these countries," observes Humboldt, "appears to announce traces of the civilization of the ancient Mexicans."

In the district of Zapoteca, in the intendancy of Oaxaca, is one of the most remarkable monuments of ancient civilization in all Mexico; the palace of *Mitla*, a name contracted from *Mignitlan*, which signifies, in Aztec, *place of woe*. The Tzapotec Indians call these ruins *leoba*, or *luiva*, (burial, or tomb,) alluding to the excavations found beneath the walls. It is about ten leagues from Oaxaca, on the road to Teuautepec. It is supposed to have been a palace constructed over the tombs of the kings, where the monarch retired, on the death of a son, a wife, or a brother. The tombs of Mitla consist of three edifices symmetrically placed in an extremely romantic situation. The principal edifice, which is in the best preservation, is nearly 130 feet long. A stair, formed in a pit, leads to a subterranean apartment, 88 feet long, by 26. This gloomy apartment, as well as the exterior walls of the edifice, is covered with *à la grecque* and *arabesque* ornaments. But what distinguishes the ruins of Mitla from all the other remains of Mexican architecture, is six porphyry columns, which are placed in the midst of a vast hall, and support the ceiling. These columns, almost the only ones found in the new continent, bear strong marks of the infancy of the art. They have neither base nor capital: only a simple contraction of the upper part is observable. Their total height is nearly 19 feet; the shaft of each is of a single piece of porphyry. The ceiling, which they supported, was formed of beams of savine wood, three of which are still in good preservation. The roof consists of very large slabs. There appears to have been originally five separate buildings, disposed with great regularity. A very large gate, some vestiges of which are still to be seen, led to a spacious court, 150 feet square. Heaps of earth, and remains of subterraneous structures, indicate that four small edifices, of oblong form, surrounded this court. That on the right is in tolerable preservation, and the remains of two columns still exist. In the principal edifice we first distinguish a terrace, raised three or four feet above the level of the court, and surrounding the walls, to which it served as a base. A niche formed in the wall with pillars four or five feet above the level of the hall, is supposed to have enclosed an idol The principal door of the hall is covered with a stone 12 feet long by 3. After entering the inner court, is seen the well. A very broad staircase leads to the excavation, which is in the form of a cross, supported by columns. The two galleries, which intersect each other at right angles, are each 82 feet long, by 25. Three small apartments surround the inner court, and behind the niche is a fourth, with which they have no communication. In the interior of the apartments are paintings of weapons, trophies, and sacrifices. There is no appearance of their ever having had windows. The *arabesque* (with which the exterior walls are covered) form a kind of mosaic work, composed of several square pieces of porphyry, placed with much dexterity by the side of each other, and attached to a mass of clay, which appears to fill up the inside of the walls. In the neighbourhood are the remains of a great pyramid, and some other buildings, very much resembling them. Mr. Humboldt observed many ornaments remarkably similar to those on the Etruscan vases of lower Italy. See *Cholula*, *Palenque*, *Pyramid*.

Of the picture writing of the Mexicans, some singular specimens have been preserved. *Purchas* has published some of the most valuable, in sixty-six plates. Thirty-two plates have been published by the Archbishop of Toledo, and others are found in various musæums of Italy, Spain, and other countries of Europe, See also *Humboldt*, Vues des Cordilleras, and *Robertson's* History of America.

MEZZANINO, a low story between two floors.

MEZZO-RELIEVO, or mean relief, in comparison with alto-relievo, or high relief.

MIDDLE QUARTERS *of a Column*, is a name given to the four quarters of a column divided by horizontal sections, forming an angle of 45 degrees from the horizontal line.

MIDDLE POST in a roof. See *King-post.*

MILETUS, an ancient and celebrated city of Asia Minor.

The ruins of the celebrated temple of Apollo Didymeus are described in the Ionian Antiquities, vol. i. p. 27. The site of this temple is in a manner buried under its vast ruins, but from the parts of columns which yet appear in their places, it is evident the front was decastylos, the aspect the dipteros, and the species between the pycnostylos and systylos, the intercolumniation being one diameter of the columns and seven-ninths. The breadth of the west front is 162′ 10″ 2; but as no trace of the east front remains, it was impossible to ascertain the length. The cella had no door in the west front, of which omission, (except in prostyle and *in antis*) examples occur in that at Jackly, that on the Ilyssus at Athens, and of Jupiter Nemæus in Achaia. The wall of the cella in the west front is 8′ 10″, it is faced on each side with large pieces of marble inclining to a lightish blue, and left rough. The internal columns of the dipteros are fluted the whole length of their shafts, but the external only two feet below the capitals, the rest of the shaft being left rough, except a few inches above the apophyges, which, as this temple was never completed, evidently proves that the fluting was finished after the columns were raised, as also the walls of the cella, which remain rough. Several capitals of pilasters remain on the north side of the temple; the profiles are not quite half the breadth of their front, from which it is evident that none of them belonged to the antæ, for the internal face of the antæ in temples have the same breadth as the front, answering to the diameter of the columns placed between them. The hem or border in front of the volûtes of the external capitals of the dipteros is left square, but in those of the internal is wrought circularly, and the flowers resting on the echinus of the former have only three leaves; of the latter, four. From the number and proportion of the capitals, without mentioning the frieze decorated with griffins and lyres, of which several fragments remain, and which undoubtedly filled the space between these capitals, it may be concluded that the lateral walls of the cella were enriched with pilasters, corresponding with the pteromata or colonnades round the temple. The griffin was particularly sacred to Apollo, and is here introduced as the guardian of the lyre.

Milliare, (Lat.) the stone or column placed by the Romans in their public roads, to mark the distances from one mile to another, and also from Rome. Hence we often find in Roman writers such expressions as *tertio ab urbe lapide*, *ad quartum lapidem*, &c. to mark the distance of three or four miles from Rome; the expression was often abridged, and only the words *ad vigesimum, ad septimum*, &c. used. Near the temple of Saturn, in the forum of Rome, was a gilded pillar, erected by Augustus, and called *milliarium aurium*, which some have supposed to have been the point from which the other distances were reckoned; but *Hennin*, in his notes on Bergier, has conjectured that it was only from this point that distances in the city were estimated, and that in the country the distances were reckoned from the outside of the capital. In 1757, between Montêlimart and Valence, a milliare was discovered, nearly eight feet high, on which might be read *sextum milliarium*, above an inscription in which occurred the name of Ælius Hadrianus. In the cemetery of the village of Saquenay, a milliary column was discovered in 1703, with the inscription *Andomatunum millia passuum xxii.* and the name of Germanicus; Antomatunum was the name of Langres, before it was called Lingones. At Juvigny, a village two leagues from Soissons, has been long preserved a milliary column with the inscription—*Millia vii. ab Augusta Suessionum.*

Minaret, (Turkish,) a circular turret rising by different stages or divisions, each of which has a balcony. They are very common in the east. The first minaret was erected at Damascus, contiguous to the church of St. John the Baptist. See *Arabian Architecture.*

Minerva Polias, *Temple of.* See *Athenian Architecture.* We will here introduce a translation of the celebrated Architectural Inscription relating to the temples of Erechtheus, Minerva Polias, and Pandrosus, which was brought from Athens, and published by Dr. Chandler. It is a survey made by order of the people of Athens, when Diocles was archon, which was in the twenty-third year of the Peloponnesian war, in the fourth year of the ninety-second Olympiad, B.C. 409, of such parts of these temples as were at that time unfinished. The marginal numbers were shewn, by Visconti and Mr. Wilkins, to have related to the number of pieces of marble belonging to different parts of the edifice, the state and situation of which are spoken of contiguous to them.

"The Epistatæ (public inspectors) of the temple in the city (acropolis) in which is the ancient statue of Brosyn * * * es of Cephissia, Chariocles of Agryle, Diocles of Cephissia, the architect Philocles of Acharnæ, the secretary Etearchus of Cydathenæum, have taken an account of the works of the temple in the state in which they found them, some finished, and some half finished, according to the decree of the people, which Epigenes proposed in the archonship of Diocles. The tribe Cecropis, being first in the council in which Nicophanes, of Marathon, was secretary of the first pytany.

"We have found these parts of the temple half finished. In the angles towards the Cecropium:

IV. Plinths (Πλινθους) not placed, four feet long, two feet wide, and a foot and a half thick.

I. Maschaliæa, or shoulder tile, (Μασχαλιαιαν,) four feet long, three feet wide, and one and a half thick.

V. Simæ, (Επικρανιτιδας,) four feet long, three feet wide, and a foot and a half thick.

I. Saddle-stone of the pediment, or angular ridge of sima (γωνιαιαν,) seven feet long, four feet wide, and a foot and a half thick.

Marble tiling (γογγυλους λιθους) not placed; continuation of the same, ten feet long, and a foot and a half high.

II. Pieces in continuation of the Epistylia (αντιμορω τοις επιστυλιοις) four feet long, five palms wide.

I. Capital of a column (κιοκρανον) which is to be between the windows (μετωπον) not placed, a foot and a half wide, and a foot and a half thick.

Epistilia, not placed, eight feet long, two feet one palm wide, and two feet thick.

III. Epistilia in their places, not worked on their surface, eight feet long, two feet and a palm wide, and two feet thick.

The Eleusinian stone, against which are to be the figures, surmounts all round the rest of the work, and is already placed over the epistylia of those columns at the wall towards the Pandroseum.

IV. Of the attached columns, a foot and a half of each from within the volute (ανθεμιον) is left unsculptured. The inner cymatium of an epistylium eight feet long, on the wall towards the south, has to be placed. These parts are unpolished and unfluted. The wall towards the south-wind is unpolished except in the portico (προστασις) towards the Cecropium.

The antæ (ορθοστατας) are not polished outside throughout, except in the portico towards the Cecropium.

All the bases are unfluted in the upper part.

All the columns are unfluted, except those upon the wall. The stylobata encircling it is all unpolished.

Of the exterior wall are unpolished: four feet length of gutter stones (γαυλου λιθου—Müller and Boëck read γογγυλου. See *Eaves.*) eight of which are at the entrance; four feet lengths towards the pilaster, four feet lengths towards the statue, four feet lengths towards the doorway. (θυρωμα) The altar of the Thyecus is not placed.

The cramps (σφηκισκοι) and the tyes, (ιμαντας) of the flat roof are not placed.

Above the portico towards the Cecropium, three stones of the lacunaria, which are over the virgins (επι των κορων) thirteen feet long, and five wide, have to be worked.

The flowers (τας καλχας—i.e. the present pateræ) which are on the epistylia, do not require finishing.

Masonry entirely finished lying on on the ground.

XI. Tiles four feet long, two feet wide, and a foot and a half thick, incomplete.

I. Maschaliæa, or shoulder tile, four feet long, three feet wide, a foot and a half thick. The alternate joint and the joints behind of each of these are not wrought.

XII. Six feet long, two feet wide, a foot thick; the alternate joint, and the joint behind, of these are not wrought.

V. Four feet long, two feet wide, a foot thick, of each of which the alternate joint, and the joints behind, are not wrought.

I. Five feet long, two feet wide, a foot thick, of which the alternate joint and joints behind are not wrought.

VII. Parts of the corona, (γεισα) four feet long, three feet wide, five palms thick, wrought smooth, without carving.

V. Others of the same magnitude, of both of which the cymatium and the astragal were unwrought, four feet.

II. Others, the cymatium was unwrought four feet, and eight feet of the astragal.

I. Another, a foot and a half of the cymatium was unwrought, and four feet of the astragal.

I. Other, the smooth work was done, but of the cymatium six feet and a half were unwrought, of the astragal eight feet.

III. Others, six feet of the cymatium unwrought, eight of the astragal.

I. Other, what relates to the smooth work half worked.

IV. Parts of the corona above the portico, four feet long, three feet wide, five palms thick, worked smooth, without carving.

II. Angular pieces upon the portico towards the east, six feet long, three feet and a half wide, five palms thick, of one of which the smooth work is done, but the entire cymatium and astragal unwrought; of the other, three feet and a half of the cymatium are unworked, and five feet of the astragal unwrought.

I. On the wall towards the Pandroseium, seven feet and a half long, three feet and a half wide, the smooth work half done.

I. Six feet long, three feet and a palm wide, five palms thick, also on the wall towards the Pandroseium; of this, five feet of the astragal are unwrought.

VI. Stones of the Tympanum, (Αιετιαιοι. sc. λιθοι. See *Eagle.*) of those belonging to the porticos, seven feet long, three feet and a half wide, and one foot thick, are half worked.

II. Others five feet long, three feet and a half wide, one foot thick, are half worked.

The corona above the pediments, two feet and a half wide, four feet and a half long, a foot wide, the smooth part is completed.

I. Other half finished in the smooth work.

II. Marble door frames, eight feet and a palm long, two feet and a half wide.

IV. These others are however completed, but the black marble has to be placed over the supercilium (ζυγα).

I. Console (ους) to the door lintel (υπερθυρον) towards the east, half worked.

III. Pentelic marbles to the altar of the Thyecus, four feet long, two feet and one palm high, one foot thick.

I. Other three feet."

In his explanation of this inscription, Müller considers the tiles (πλινθοι) to be the blocks of marble composing the southern wall, and the επικρανιτιδες to be the capitals of the walls, i.e. the blocks forming the continuation of the lines and ornaments of the capitals of the antæ, the *γωνιαια* being the angular stone of the same range. The *ανθεμιον* he supposes to be the flatted torus above the echinus, between the volutes, peculiar to this example of the Ionic order. The term *σφηκισκοι* he supposes to refer to the dentils of the Caryatic building. See in explanation and illustration of this inscription, Chandler's Inscript. Antiq. pl. ii. In. 1.—Müller de Minervæ Pol. Templo.—Böeckh. Corpus Inscript. Græc. pl. ii. ch. ii. p. 264.—Vitruvius, ed. Schneider, vol. ii. p. 260.—Rose, Inscript. Græc. p 130.—Wilkins, Atheniensià.—Walpole's Memoirs, vol. i. p. 591.

Minerva Polias at Priene. See *Priene*.

Minion, an ore of iron used in mortar; with lime and sand, it forms a water cement.

Minute, (Lat.) the lower diameter of a column is divided into 60 equal parts, called *minutes*, which are used in measuring the proportions of the other parts.

Minster, (*minstere*, Sax.) a monastery; an ecclesiastical fraternity; a cathedral church. This name is yet retained at York, Beverley, and Litchfield.

Misericord. See *Abbey*.

Mitchel, Purbeck stones of 15 inches by 2 feet, when squared for building have this name given them by the workmen.

Mitre, an angle of forty-five degrees, a half of a right angle.

Mitre, in carpentry, is the name given to the joint formed between two pieces of wood fixed to each other by the formation of an indenture in each to correspond with the other, so that the two surfaces may coincide when brought together. This mode is sometimes employed to hide a dovetail, and is called lap-and-mitre joint.

Mitre Box, a block or frame for cutting mitres.

Mixed Angle, an angle formed by one right line and one curved line.

Mixed Figure, one consisting of straight and crooked lines.

Mnesicles, a Greek architect, who superintended the building of the Propylæa. (Plutarch in Vit. Periclis.) See *Propylæa*.

Moat, *ditch*, *fosse*, or *vallum*, terms used to express a hollow space on the outside of the walls or ramparts of ancient fortresses. When the moat was dry, there were sometimes subterranean passages, through which the cavalry could sally.

Model, see *Effect*.

Modillion, (*modillon*, Fr.) a projection under the corona of the richer orders, resembling a bracket. The Grecian Ionic has no modillions, and the Roman Ionic but seldom. The modillions of the frontispiece of Nero at Rome, consist of two plain faces, separated by a small cyma reversa, and crowned with an ovolo and bead. In the frieze of the fourth order of the Colosseum, the modillions are cut on the outside in the form of a cyma reversa. See *Plate* M. 4.

Modular Proportions, is a term applied to building, in reference to the module, according to which they have been erected. See *Module*.

Modulation, (from *modulor*, to regulate,) the proportion of the parts of an order.

Module, (Lat.) the semi-diameter of the lower part of the shaft of a column, equal to 30 minutes. Vignola divided the module into 12 parts in the Tuscan or Doric, and 18 in the other orders.

Moineau, (Fr.) in perfect fortification, a little flat bastion raised before a courtin which is too long.

Mole, (*mœl*, Sax.) a pier of stone, to shelter ships from the violence of the waves. Amongst the Romans, the name was given to a kind of circular mausoleum, as that of the Emperor Adrian. See *Adrianeium.*

MONASTIC BUILDINGS. The first simple habitations of the monastic recluse was a cave in the rock, or a hut of the rudest construction, but from that æra to the dissolution of those institutions in this country, many of the buildings for religious devotees had become highly ornamented, and some of the most elegant cathedral churches arose from the ruins of monasteries. The ornamental improvement in these buildings is believed to have commenced with the Conquest, and ended in the time of Henry VIIIth; an opinion confirmed by an examination of the remains of ancient edifices, with a reference to the periods of their erection.

The seals of the kings, in Speed's History of England, give a complete and just view of the different modes of architecture which prevailed in their respective reigns; in these, each king is represented sitting enshrined amid a sumptuous pile of architecture. Henry III. is seated among arches of the round Saxon form. So are his successors, Edward I. and II.; Edward III. is the first whose seal exhibits pointed arches, and those are of the simplest kind. Richard, prior of Hexham, flourished about A.D. 1180; and about this time, as he informs us, St. Wilfred presided over nine monasteries, some of which were of the most elegant and sumptuous kind; and it cannot be doubted that these buildings rose in elegance, and became more ornamented as they became richer. The famous abbey of Ramsey, in Huntingdonshire was founded by Ailwin, alderman of all England, as he is styled, with the assistance of Oswald, bishop of Worcester, afterwards archbishop of York. Its church, which was six years in building, is described as of great elegance, in the form of a Roman *basilica*, but, as far as we can learn, the Monastery itself was not distinguished from other structures, merely adapted for convenience as a receptacle for a numerous society.

The abbey church of St. Alban's, erected in honour of the first British martyr, remains, the most venerable monument of christian antiquities in the kingdom. This church, or monastery, had the precedence of other abbeys given to it in 1154, by Pope Adrian the Fourth, an Englishman, born near the place, on account of its being erected to the memory of the proto-martyr of England, it was therefore judged proper that St. Alban's abbot should be the first in England in order and dignity. This august, ancient building is in the form of a cross, with a high tower in the middle. It is constructed of old Roman bricks from the ruins of the Roman city of Verulam, which was removed, to found the town and monastery to honour the martyr's grave. The length of the building, from east to west, is 600 feet, of which 411 feet is the extent from the western door to the high altar, from which to the end of the Lady chapel, including the shrine of the saint, is 189 feet. The great cross isle from north to south measures 180 feet, which corresponds with the height of the great tower in the middle; the breadth of the body of the nave, including the side aisles, is 72 feet, and the height of it measures about the same. The roof of the cross aisle and the west end, with the Lady chapel, are wainscoted, but the choir is vaulted with wood, and painted. A little above the middle of this vaulting, is the stately high altar, built by William Walling-ford: it is a beautiful specimen of ornamental stone-work, originally overlaid with gold and silver; probably one of the most splendid in the kingdom. But all these images are gone, as well as the shrine and the brass font brought out of Scotland; a wooden shrine has since been put up, with this inscription on black marble:—*Sanctus Albanus, Verolamensis Anglorum Protomartyr*, 17 *Junii*, 293.

The original foundation, by king Offa, was in 794. All the offices, the library, cloisters, chapter-house, &c. are demolished, except a large gate-house, and vestiges of the cloisters on the south side, with the door-way from the south aisle, and the marks of the arches on the outside, from which we learn that they were 129 feet in length, and 21 in breadth. The whole of the remaining fabric is leaded over, and the brick walls covered with plaster or stucco, of superior hardness and stone-like appearance.

The ancient Cistercian monastery of Whalley, on the banks of the Calder, in Lancashire, has been destroyed, as all the buildings of this description were, at the Reformation, but the ruins have been partly preserved, and incorporated with a family mansion. We cannot better illustrate this subject than by giving the following description of this abbey, from Mr. Whitaker's History of Whalley:—

"The area of the enclosure, containing 36 acres 3 roods 14 poles, is still defined by the remains of a broad and deep trench, which surrounded it; over this were two approaches to the house, through two strong and stately gateways, yet remaining. They are constructed in that plain and substantial style, which characterized the Cistercian houses; a style which approximates to that of fortification, and shows that the monks did not obtain a license to kernel and embattle, without an end in view. Within this area, and on the verge of the Calder, which formed the south-west boundary of the close, was the house itself, consisting of three quadrangles, besides stables and offices. Of these, the first and most westerly was the cloister-court, of which the nave of the conventual church formed the north side; the chapter-house and vestry, yet remaining, the east; the dormitory, also remaining, the west; and the refectory and kitchens, the south. The cloister was of wood, supported, as usual, upon corbels, still remaining; the area within was the monks' cemetery, and some ancient gravestones are still remembered within it. Against the wall on the south side of this quadrangle, is a wide surbased arch, apparently of Henry the Eighth's time, which has evidently contained the lavatory. The groove of the pipe of lead which conveyed the water, is still conspicuous, as is also another for the reception of a wooden rail, on which the towels hung. Beyond this court, to the east, is another quadrangle, formed by the choir of the church on one side; the opposite side of the chapter-house, &c. on another; a line of ruinous buildings on a third; and a large distinct building itself, surrounding a small quadrangle, on the fourth. This appears evidently to have been the abbot's lodgings; for which reason, as being best adapted to the habits of an ordinary family, it immediately became the residence of the Asshetons; and after many alterations, and a demolition of its best apartments, particularly a gallery nearly 150 feet in length, has still several good and habitable rooms, and is now preserved with due care by its owner. The ancient kitchen, the coquina abbæ of the Compotus, whence such hecatombs were served up, remains, though roofless, with two fire-places. On the southern side of this building is a small, but very beautiful and picturesque ruin, mantled with ivy, which appears to have been a chapel, and was probably the abbot's private oratory. But the conventual church itself, which exceeded many cathedrals in extent, has been levelled nearly to the foundation."

A very curious plan of a monastery, from an ancient manuscript, is given among the "Vetusta Monumenta," published by the Society of Antiquaries.

The *mandræ*, or early monasteries, of Ireland, are composed of rude Cyclopean masonry, without cement, being mere *superterraneous* caverns. At Inis Murray is an enclosure of walls, from five to ten feet thick, rough, and built of large stones, without mortar. Within are cells covered with earth, thrown up so as to make them in a manner subterraneous, with a small hole at the top, and another on the side, apparently more for air than light. They have all been vaulted with the same rude stone. The entrance into the enclosure is so narrow as scarcely to admit a man to pass. Within are three square chapels, dedicated to St. Melas and Columbkill, built of stone and lime in a rude manner, but modern compared with the rest of the building. An altar, or single stone, is enclosed within another square wall. Dun Angus, in the Isle of Arran, on the coast of Galway, is a circle of monstrous stones, without cement, of which the monastic appellation is *mandræ*. Within one of these mandræ, or stone circles, stood, among the Orientals, the pillar which Simeon Stylites occupied. The appropriation of these buildings to the early monastic uses, is proved by Bede's description of a religious house, built by Cuthbert. The building was constructed around four or five perches, made between wall and wall. On the outside the wall was the height of a man, but in the inside higher, which was done by sinking the rock, and intended, by restraining the light, to prevent the thoughts from rambling. The wall was of rough unpolished stones, with turf dug up in the middle of the place, and banked on both sides of the stone all around. Some of the stones were so large that four men could hardly lift them. Within were two houses and a chapel, with a room for common purposes, the roofs of unhewn timber, and thatched. Within the walls was a house for the reception of strangers, and a fountain of water. (Ledwich's Ireland.) The size of the stones may be traced to the Cyclopean architecture, and the mode of building was probably derived from Druidism. This was not the only druidical or pagan interpolation. At Kildare, where once stood a temple resembling Stonehenge, was a nunnery, said to have been founded by St. Brigid before 484, and about the same time an abbey was also formed under the same roof for monks, but separated from the nunnery by walls. In 1220, Henry de Lowndres, archbishop of Dublin, quenched the fire which had been kept perpetually burning by the nuns, and which was called unextinguishable. It was, however, relighted, and continued to burn till the suppression of monasteries. (Hoare's Tour; Fosbrooke's British Monachism.)

At Inismore, or Church Island, in Sligo, in a rock near the door of the church, is a cavity called our Lady's Bed, into which pregnant women go, and turn thrice round, with the repetition of certain prayers, fancying that it will preserve them from death in childbed. This is evidently derived from the Druidical *deasuil*. The monks of Ireland were of such holy celebrity, that in the Legends of St. Brandon, the Egyptian hermit, Paul is made to say, "Somtyme I was a monke of Saynt Patrike's Abbey in Yreland, and was wardein of the place, whereat men entre into Saynt Patrike's purgatorie."

Those singular monuments, the *Cloghads*, which are ascribed to the ninth century, are tall slender round towers, found annexed to various Irish churches. Some have supposed them to have been residences of fire-worshippers. Col. Morres says, that the founders of these towers were the primitive cœnobites and bishops. Only two are known out of Ireland, at Abernethy and Brechin. (Sir K. C. Hoare's Irish Tour, p. 279. Archæologia, vol. ii. and vol. ix.—Ledwich's Ireland.)

Monkey, a name given to a block of iron, with a catch, used in gins, for driving piles.

Monolithal, (μονος, *one*, λιθος, *stone*, Gr.) works constructed of one stone. M. Denon has given representations of several subterraneous structures worked in single rocks, together with sundry little monolithal temples.

Monopodium, (Gr.) a table with one leg.

Monopteral, (Gr.) a species of temple, of a round form, which had neither walls nor cella, but only a cupola sustained by columns. The base of the columns is raised by one-third of the diameter of the temple; the height of the columns was equal to the diameter of the temple taken at the outer side of the pedestals; their thickness was one-tenth of the height of the shaft and capital; the architrave equalled in height half the diameter of the column.

Monotryglyph, (Greek,) the space of one triglyph and two metopes, between two Doric columns.

Montmorillon, a small town, about eight leagues from Poictiers, celebrated for an ancient building, which is generally supposed to have belonged to the ancient Druids, and of which engravings have been given by *Montfaucon*, in the supplements to his *Antiquité Expliquée*, and by *Martin*, in his work on the religion of the Gauls. The statues which adorn its portal, they suppose to be Gaulish divinities, and Martin thinks, that one of them is meant for a personification of the moon, and that the edifice was a temple dedicated to the lunar goddess. *Millin*, however, considers it as nothing more than an old Christian church of the tenth or eleventh century, and judges that the figures are only the works of fancy, and have no specific meaning.

Monument, *the London*, was erected by order of parliament, to commemorate the burning of the city in the year 1666. This magnificent pillar was designed by Sir Christopher Wren, and marks the place where the fatal fire commenced. It is of the Doric order, fluted, the height 202 feet from the ground; its diameter is 15 feet. It is of solid Portland stone, enclosing a staircase of black marble, with 365 steps. The pedestal measuring 28 feet in circumference, and its height is 40 feet: its front is covered with numerous figures in *basso-relievo*. It has a balcony 32 feet from the top, which is ornamented by a spacious blazoning urn of gilt brass. This erection was begun in 1671, and finished in 1677.

MONUMENTS. See *Sepulchral.*

MONUMENT OF LYSICRATES. See *Athenian Architecture.*

MOORISH, or MORESK. See *Mauresque*

MOOR-STONE, a kind of granite found in Cornwall, and some other parts of England, and of great value for the coarser parts of building. Its colours are chiefly black and white, and it is very coarse. It is found also in immense strata, in some parts of Ireland.

MORTAR, the calcareous cement used in building, compounded of burnt limestone and sand. Limestone or chalk, slowly calcined till all its carbonic acid gas is expelled, loses about 44 per cent of its weight, and becomes what is called slacked lime, on the application of water, falling into a fine powder: suddenly formed into a stiff paste with water, this powder becomes hydrate of lime, assuming a solid form, and, as it attracts carbonic acid from the air, hardens, and constitutes the common builder's mortar. Hydrate of lime, without any other ingredient, whilst in a moist state, falls away and is dissolved in water. Alumina, silica, and manganese produce the same effects with lime, but in an inferior degree. If any substance in powder, which contains much iron, be added to this mortar, its hardness and compactness is much increased, and it also acquires the property of hardening under water, and is denominated Roman Cement, or Water Mortar. In these combinations, if the lime should be in excess, it separates, either crystallizing or forming stalactes; by which it appears that a definite proportion of the materials is necessary to form the best cement.

Various additions are made to mortar, for the purpose of increasing its hardness or tenacity, which for this purpose must be reduced to a fine powder, and the whole intimately kneaded together, and wrought to a smooth consistence: puzzalana, terras, iron ores, basalt, and other similar substances, in considerable variety, with sand of various descriptions. Common limestone, (the *chaux maigre*, or poor limestone, of the French) consists of nearly pure carbonate of lime. It slacks freely, and produces white lime, and, with the addition of sand, good common mortar. The species of lime includes chalk, marble, &c. Chalk lime is seldom sufficiently burnt, and more quickly absorbs carbonic acid than stone lime. Silicious limestones give a buff colour. Those stones which are almost entirely constituted of pure carbonate, as is the case with respect to most of the varieties of marble or limestone called *rich*, when burned, slacked, and made into paste, will retain their softness under water, or otherwise excluded from the air, for almost any length of time; whilst those stones in which calcarious matter is found mixed with sand, silex, alumine, and iron, and which are called *meagre limes*, if treated in the same manner, quickly harden under water, and in time form a kind of free-stone, which cannot be easily broken: from this circumstance it is called *hydraulic* lime. Mortar of this lime, when exposed to the air to dry, acquires a crumbly consistence; and these kinds of lean lime, which contain an excess of *silex*, are found unfit for hydraulic cement. The *rich* lime, exposed to the air, mixed with a due proportion of sand, acquires a great degree of hardness. Puzzolanas are either natural or artificial.

The natural are found in situations which have been acted upon by subterraneous heat. They all consist of silex, alumine, oxide of iron, and a little lime; their properties vary greatly, silex or clay being the predominating ingredient; the lime and iron sometimes, though rarely, wanting. The scoria of forges and furnaces, broken pottery, and pulverized brick or tile, are artificial substances analogous to puzzolanas. One class of puzzolanas, containing a large proportion of clay or argil, resist the action of sulphuric acid: another class, with a less proportion of clay, easily dissolve with this acid, and abandon the clay, which immediately subsides. From very rich slacked lime, with sand alone, or with puzzolana, which resists the action of sulphuric acid, we obtain a mortar which, placed under pure water, remains always soft, or acquires a feeble consistence. Exposed to the air, this mortar soon acquires a crumbly consistence, but never hardens. If the same experiment be made with a puzzolana readily decomposed by sulphuric acid, a mortar is obtained, which soon sets under water, and becomes gradually harder, but, exposed to the air, it *dries quickly*, and consequently never becomes very hard. Since the quality of natural hydraulic lime depends on the mixture of various ingredients, with only a *certain proportionate quantity* of clay, combined by heat, it is natural to suppose that an artificial mixture of the same materials, submitted to heat, would produce a compound of equal efficacy. Experience has abundantly confirmed this opinion, and it is now known that an artificial hydraulic lime may be prepared almost in any place, at a moderate price, and superior to the natural.

M. Berthier is of opinion, that, with one part of common clay, and two parts and a half of chalk, a very good hydraulic lime may be made, which sets as quickly as Parker's cement. He concludes, that a limestone, containing six per cent of clay, affords a mortar precisely hydraulic. Lime containing from fifteen to twenty per cent, is very hydraulic; and when from twenty-five to thirty, it sets almost instantly, and may therefore be held to be a true Roman cement. But an argillaceous limestone, which, when slacked, *increases in bulk* from one to three parts upon ten, and which when in the form of a slacked paste will take from one hundred to one hundred and sixty or one hundred and eighty measures of sand, will afford, at a moderate cost, a cement equally fitted to resist the changes of weather, and the constant exposure to a running stream. A little magnanese added to mortar gives it the property of hardening under water. Limestone is frequently found combined with this mineral, which gives it a brown colour when burnt.

Sharp coarse sand is the best for mixing with the lime, and it should be divested of the clay or mud which generally adheres to it. If sea-sand be used, it will require to be freed from alkaline salts, and other impurities, by washing in fresh water; but for the purpose of mixing or slacking the lime, sea water is injurious, as it prevents the mortar from becoming perfectly dry. In drying, sand is not diminished in magnitude, but lime shrinks much, therefore the greater the proportion of sand, the sooner the mortar sets, and the harder it will be when dry; but though many valuable treatises have been written on the subject, and nice experiments made, the exact proportions of the lime and sand, have not yet been ascertained. According to Vitruvius, the Romans prescribed three parts of coarse sand to one of lime; and, according to Pliny, four of the former to one of the latter. The usual proportions of the London builders, is two loads and a half of sand to thirty-seven bushels of lime.

If the mortar be well beaten, it will take a greater proportion of sand, and will be proportionably improved; and it is agreeable to an observation of Mr. Smeaton, that one measure of unslacked lime, well beaten, will always require two measures of sand for mortar of any kind; and the greater the proportion of sand, the more it is to be beaten.

The mixture of fine and coarse sand is found to improve the composition of mortar, and Dr. Higgins gives the following, as the best proportions of each. Newly-slacked lime, 1 part; coarse sand, 4 parts; fine sand, 3 parts. The addition of ¼ of the quantity of the lime, of burnt bone ashes, improved the composition, giving a greater degree of tenacity, and causing it to dry without cracks.

Mortar is best made in a vault or cellar, and kept covered up from the air; when used, it must be beaten up, and brought to a proper consistence.

Grout is a diluted kind of cement, sufficiently fluid to fill up the irregular spaces between the stones of rough walls; if it be made of mortar that has been well beaten in the making, and *kept a long time*, it will then set in a few days; but if new-made mortar be used, the grout will be a long time before it hardens, or perhaps it will [illegible]er properly set.

Common mortar, even when thoroughly dry before the water is admitted, is by no means well adapted to the purpose of lining reservoirs or aqueducts; but if a certain portion of burnt clay be mixed with the lime, the mortar will set and harden under water. To give this property to cement, various ingredients have been added: coal-ashes, wood-ashes, coal-cinders, brick-dust or burnt clay, pumice-stone, unslacked powder of quicklime, forge scales, roasted iron ore, wakke, or compact basalt, cellular basalt, puzzolana, &c.

In the construction of the Eddystone lighthouse, Mr. Smeaton used equal quantities of puzzolana and Aberthaw lime, as the mixture best calculated to withstand the utmost violence of the waves, continually beating against the foundation of that building. Two bushels of slacked lime, from Aberthaw, one bushel of puzzolana, and three of clean sand, will form a good water cement; and in various parts of England, as at Tinker's-hill, near Ludlow, and places bordering on Wales, a peculiar kind of lime is found, which, if properly prepared, forms, with sand only, a mortar which will set and harden under water. The substance called puzzolana was discovered by the Romans near the town of Puteoli, not far from Mount Vesuvius, and was first used for buildings bordering the bay of Baiæ, some of which were built in the water. The only preparation this substance requires, is pounding and sifting, in which state, when mixed with lime, it is found to possess, in the highest degree, all the requisite properties of a water-cement.

No nation in Europe has had so much occasion for water-cement as the Dutch, and the substance called *terras*, or *trass*, was first used by them. This substance which is also called wakke, is a species of basaltes, which has proved extensively useful in forming mounds, and various aquatic works, in the Low Countries. This celebrated terras mortar is made by covering a previously prepared mass of quicklime, of about a foot thick, (and sprinkled with water,) with an equal quantity of powdered terras. The whole is then left at rest two or three days; after which, what is wanted, is taken each day, and beat up for use.

One measure of quicklime, and two of slacked, in powder, with one of terras, the whole well beaten to the consistence of paste, with as small a portion of water as can be made sufficient, forms the terras mortar commonly used in England. A cheaper kind is made by mixing two parts of slacked lime, and one of terras, with three of coarse sand.

Pebble mortar is used when cavities occur in walls, between the unequal projections of unhewn stone: it was much used by the Romans, and is yet of great utility, where large quantities of mortar are required. For this purpose, take one part of terras, or of puzzolana, two of coarse sand, two of fine sand, eight of small pebbles, screened and washed, and four of slacked lime. Mix the whole together. The lime termed argillacious, from its containing a portion of clay, is preferred for this purpose.

It is only under water, or with the exclusion of air, that terras mortar acquires its usual degree of hardness; for, when exposed to the action of the atmosphere, it will not become as hard as common mortar.

Though the experiments of Morveau have proved that common *compact basalt* will, when previously burnt, make nearly as good a water-cement as the cellular species, (the terras of the Dutch,) yet it has rarely been used for that purpose. This mineral abounds in Great Britain, and the expense of its importation might be saved to the country. Calton-hill, in the vicinity of Edinburgh, and near the port of Leith, is almost one entire mass of basalt.

The cendre de Tournay is used in the Low Countries; this article is procured from the lime-kilns bordering the Scheldt: the lime of this district contains a considerable portion of clay mixed with iron; and the pit-coal, with which it is burnt, contains a large quantity of an argillacious schist impregnated with iron. After the lime is taken out of the kilns, there remains the *cendrée*, about one-fourth of which consists of burnt lime-dust, and three-fourths of coal-ashes. This material is sprinkled with water, to slack the lime, and well mixed together, and put into a proper vessel, and covered over with wet earth. In this state it is kept for a considerable time, and, when taken out, and strongly beaten up for half an hour with an iron pestle, in a wooden mortar or trough, it is reduced to a soft pasty consistence; it is then spread out in a shady place several days, and the operation of beating repeated; the oftener this is done, the better, except it should become unmanageable from being too much dried. In a few minutes, this cement, when applied to brick or stone, adheres so firmly, that water may be immediately poured over it; and if kept dry twenty-four hours, it will receive no injury even from the most violent action of a flowing stream.

In London, a blue mortar of cinders and lime is used for covering some parts of buildings much exposed to the weather; and if this were prepared with the same labour and attention, it might be expected to possess, in a great degree, the valuable properties of the *cendrée* mortar of the Scheldt.

Common mortar of ashes is made by mixing together two bushels of newly slacked lime, and three bushels of wood ashes, which when cold is well beaten; in which state it is usually kept for a considerable time, and, if beaten two or three times previous to using it, will be found to be improved by keeping. In resisting the effects of alternate moisture and dryness, this mixture is superior to terras mortar, but not nearly equal to it under water.

Mr. Smeaton has ascertained, by a course of experiments, that the scales (*the grey oxide of iron*) that fly off under the forge hammer from red-hot iron, pulverized and sifted, and mixed with lime, form a valuable cement, equal to that of puzzolana. In pursuing these experiments, roasted iron ore produced an efficacious water cement, by using a greater proportion of it than either terras or puzzolana. Equal quantities of iron scales and argillaceous lime, with half the quantity of each of these of sand, produced a cement in every respect equal to terras mortar. If pure carbonate of lime be used, equal parts of each of the ingredients ought to be incorporated.

About forty years ago, M. Loriat believed he had discovered the true process of making the celebrated cement of the Romans. His supposed discovery is merely the adding of the powder of dry burnt lime to common mortar, of a consistence rather thinner than usual. The lime powder, when of a right proportion, and well worked together, sets without cracking, acquires the consistence of plaster of Paris, and is as dry in two days as common plaster is in several months. The proportion of quicklime powder in the Loriat mortar varies as the other materials vary in quality; one-sixth of the other materials is frequently too little, and one-fourth not too much; experience alone can determine. As a water cement it is of inferior utility, and very little better than common mortar dried before the admission of water upon it.

Brick or tile powder, and forge scales, are added, to improve this composition, as in the following receipt:—Take of bricks, in fine powder, one measure, of fine river sand two measures, old slacked lime to make a mortar in the usual manner, and, lastly, add one measure of dry powder of quicklime. About the time of M. Loriat's discovery, Mr. George Semple published a treatise on building, in Ireland, in which a similar mode of preparing a water cement was given, as follows: "Get your lime brought to you hot from the kiln, and immediately pound or grind it with a wooden maul, on a smooth large stone, or a dry boarded floor, till you make it as fine as flour; then, without loss of time, sift it through a hair or wire sieve, and to a quantity of a hod of your setting mortar, (which on this account should be poorer than ordinary,) put in two or three shovel-full of this fine flour of lime, and let two men, for expedition's sake, beat them together with such beaters as plasterers make use of, and then use it immediately."

Plaster of Paris, with a proportion of one-tenth of rust of iron, makes a water cement, which sets almost instantly, and is of great hardness, and if boiled patatoes be incorporated with mortar of lime and sand, or with mortar containing burnt clay, these compositions will be much improved.

M. Vicat has, by numerous experiments, found that calcarious stones, slightly or imperfectly calcined, will produce a Roman cement; and in the 83rd volume of Annales de Chimie, it is stated that powdered chalk, heated from six to thirty minutes on a red-hot iron plate, acquires the property of setting in water, when slacked stiff like plaster of Paris. Yet the result of these experiments seems only to have established the generally received opinion that no Roman or hydraulic cement of a sufficient hardness can be obtained from purely calcarious stones.

The Greek and Roman architects gave the name of Maltha (Μαλθα) to a calcarious cement used as stucco, and this and the term Mastic are given to various compositions. The mixture of milk with sand and lime, is said to have constituted the *maltha* of the Greeks; and we learn from Pliny that Roman *maltha* was made by mixing fresh burnt lime, slacked with wine, and beat in a mortar, with hog's lard and figs. This composition possesses great tenacity, and acquires the hardness of granite. A second kind was made of powder of slacked lime, with bullock's blood and powdered scales of the grey oxide of iron. Previous to the application of the maltha, the surface of the wall or ceiling was smeared over with oil, to make the composition adhere.

The inhabitants of Tunis, and other places in Africa, use a species of *maltha*, which has gained great celebrity. The process of preparing it is, according to Dr. Shaw's account, as follows. To one measure of sand, two of wood ashes, and three of sifted lime powder, are mixed, with a sprinkling of water. After the mixture has been subjected to the operation of beating, a little oil is added; the beating is then resumed, and continued for three or four days, during which the proper degree of softness is preserved by alternately adding small quantities of water and oil. In a short time after its application in the usual way, it acquires the hardness of stone.

In a mausoleum of some of the Tartar princes, the spaces between the bricks are about an inch broad, and filled with a cement which appears to have been applied in a liquid state, and it has acquired such a solid consistence, that it is easier to break the well-burnt bricks than to separate the cement, which is of a grey colour, and appears to have been a mixture of unslacked lime, pulverized charcoal, and pounded sand-stone.

Parker's Roman cement, as a facing to brick and other walls, is a composition forming an artificial stone, and, being water-proof, excellently adapted to this purpose; if the wall be previously wetted, it will adhere firmly. Arch stones, cornices, and ornamental parts of buildings, may also be conveniently made of this material. An account of it is given in vol. xxvi. second series of the Repertory of Arts.

This valuable composition has been long known, and was first brought into public notice under the name of *Parker's Patent Cement*, sold by Messrs. Ch. Wyatt, and Co. Bank Side, London, at 5s. 6d. per bushel; it is now sold at about 3s. per bushel by various dealers. This material is mixed with an equal quantity of sharp grit-sand, freed from impurities, and when beaten up with a due proportion of water, forms a handsome and durable covering for the outsides of buildings. If the sand should have been previously moistened, the cement must be immediately used, and in no case mixed up beforehand. To give a proper finishing to this kind of work, a mixture of five ounces of sulphat of iron to a gallon of water, is mixed with as much lime and cement as will produce the consistence and the colour required, for a wash to be applied to the surface of the work. Sometimes the colour is modified by vitriolic acid, and when the face of the work is made to imitate bonded masonry, the intersecting spaces are tinted with umber. It is generally calculated, that one bushel of cement, properly applied, will form a superficial covering of nearly four square yards. In performing this work, which is called Floating, laborious, unceasing, and quick action will be required, as the composition sets almost instantaneously.

Carbonate of lime, calcined at a heat not exceeding that at which cast-iron softens, and cooled without access of atmospheric air or moisture, acquires the property of quickly hardening under water; and, mixed with silicious sand and water, forms an artificial puzzolana or Roman cement, and for this discovery a patent was granted to Mr. James Frost, on the 3rd of April, 1823. The process is described in the 44th vol. of the Repertory of Arts and Manufactures. A patent was also granted to Edgar Dobbs, of Southwark, for a variety of compositions to form a water-proof cement, mortar, or stucco, which in a diluted state are also applicable as durable colouring washes for buildings. These compositions consist of carbonate of lime, burnt as for common plaster, and mixed up with water, clay, loam, mud, shale, road-dust, soil, cheap metallic oxydes; ores; sand, or any earthy substance which may be subjected to the heat above specified. The whole of these ingredients are then to be reduced to fine powder, mixed with water, and left in proper vessels till it has subsided. The water is then to be poured off, and the plaster materials formed into square pieces, and dried; after which they are subjected to the heat of a lime-kiln or stove, and, lastly, mixed with the lime and water for the intended purposes.

One hundred parts of quicklime, five of white, or other coloured clay, and two of yellow-ochre, forms a cement, which is tenacious, and remains unchangeable when exposed to the weather. The lime must first be slacked with a small proportion of water, more of which must afterwards be mixed till of the consistence of cream. White clay is at the same time mixed with water to a similar consistence, and after having remained some time separate, the two solutions are carefully mixed together. During its continuance in the tub for twenty-four hours, this mixture is frequently stirred; and after that period a portion of yellow ochre is incorporated with it, to give it a pleasant colour. Walls covered with this cement, have remained exposed to south-west winds and rains for two years, without injury.

A composition, said to be equal to the Roman cement, is made, by dissolving three pounds and a half of sulphat of iron, and mixing it with a bushel of lime, and half a bushel of fine gravel sand, previously made into mortar.

Artificial puzzolana is made by heating of slacked lime one part, to three parts of clay, and keeping of a red heat several hours. After which, cover the top of the kiln with sand or earth, and, when cool, pack up close in casks for use. A composition, consisting of limestone, road dust, sand, or similar substance, with powder of burnt bones; these ingredients powdered, are to be heated in an oven, and when hot to be mixed with one-fourth part of tar, pitch, or rosin, and used to form a facing for houses.

Cement for mouldings, is made of powdered whiting two pounds, glue one pound, with half a pint of oil. This mixture is first thoroughly incorporated in a metal vessel, by means of heat, and well beat together on a stone with whiting, till it has acquired the necessary consistence and toughness. It is kept under moist cloths till used. Proper moulds are used for casting ornaments of this composition, which when dry are fixed on the surfaces to be ornamented, by glue or white-lead.

A delicate cement is made for small work, by heating a pint of milk to the boiling point, and adding vinegar 'till the curd separate; then straining off the whey, which is carefully beaten up with the whites of four or five eggs, gradually adding the whey; when the whole is well mixed, sifted quicklime is stirred in, till the consistence is that of a thick paste. It is used, to supply deficiences in small works, and to fasten pieces broken off, which it joins firmly together. It resists the action of fire and water. The prepared liquid may be kept, if closely corked up, but the lime must only be added when wanted.

Half a pound of bees-wax, sliced, melted with a quarter of a pound of rosin, powdered, and an ounce of chalk and of brick dust, both in fine powder, added, the whole boiled up together and well mixed, forms a valuable cement for filling up holes either in stone or marble, and for veneering marble for inlaying, and mosaic work. The cement must be used hot, and the work it is applied to must be warmed.

The cold cement for the same purposes is reckoned a secret among workmen; it is made by grating, with a bread grater, a pound of old dry Cheshire cheese, which must remain fourteen hours in a quart of milk, stirring it frequently; a pound of unslacked lime in powder must then be added, and the whole well beat up. Finally, add the whites of twenty or thirty eggs beat up with any colouring matter desired, and let the whole be exceedingly well mixed and beat up together.

Mr. Beavan's Mortar. This mortar, or building cement, is composed of marble, flint, chalk, lime, and water; and when dry is capable of a high polish. The proportions are one part of pulverized marble; one part of pulverized flint; and one part of chalk—mixed together, and sifted through a very fine sieve: to this is to be added one part of lime which has been slacked three months, and sufficient water to make the whole into a thin paste; in this state it is to be spread over a coarse ground, as thin as possible, and made smooth on the surface; it may be polished, when dry, by Venetian talc. If buildings are to be covered with this composition, a preparatory rough ground should be first used, consisting of river-sand and lime.

Derbyshire Spar Cement, is made with about eight parts of resin and one of bees' wax melted together, with a small quantity of plaster of Paris; if small deficiencies occur in the article to which it is applied, a little more of the plaster of Paris may be added, and, when the mixture is nearly cold, it must be well kneaded together.

When used, this cement must be dissolved by heating the portions of spar to be fastened together. A mixture of melted sulphur and some of the spar, powdered, is sometimes used for this purpose.

Steam Cement, is not only useful for different parts of hydraulic and steam engines, but for broken stones, and the joints of square water-troughs. Linseed oil boiled, litharge, and red and white lead, constitute this cement, which is mixed to a proper consistence, and applied on each side of a piece of flannel, previously shaped to the joint of iron or other substance, and put between the pieces previous to their being screwed or hammered together, or "brought home," as the workmen term it: by this means a close and durable joint is made. Care must be taken not to leave the mixture too thin with oil; and as the white lead does not dry so soon as the red, more of the latter ought to be used. Workmen do not always produce a good joint on the first attempt, but repeatedly loosen and fasten the parts of the work till they at last accomplish their purpose. When the fittings will not admit the thickness of flannel, linen or even paper or thin pasteboard may be substituted.

This cement answers well for joining broken stones of the largest kind; and stone joints never leak, or want future repairs: if the stone be thick, not more than an inch next to the water need be filled with cement; the rest may be done with common mortar. Two ounces of sal ammoniac, one ounce of flowers of sulphur, and sixteen ounces of cast iron filings or borings; mix them in a mortar, and keep the powder dry. When this cement is wanted, take one part of the above, to twenty parts of clean iron filings or borings, and mix intimately, and beat to a powder in a mortar. When mixed to a proper consistence with water, apply with wooden or iron spatula. This is the cement used in the filling up and clasping the joinings of Southwark cast-iron bridge. The chemical action of these materials, on one another, causes the whole to unite in a hard and homogeneous mass.

The roofs and floors of houses in Venice are covered with a cement, the composition of which is unknown in England; it resists the action of the weather, and preserves itself from injury for a long time. It is believed to be compounded of plaster of Paris, sulphur, resin, pitch, and spirit of turpentine or wax, mixed hot.

Walls and floors are sometimes made of mortar; as also the roofs of houses. For plain country habitations, the floors may be made of two-thirds of lime, and one of coal ashes well sifted; with a small quantity of loam, or clay; mix the whole together with water, and temper well, and make into a heap; which after remaining a week or ten days, temper over again, beating it till it be of a proper tenacity and consistence. The ground being made level, lay the composition about two inches and a half or three inches thick, making it smooth with a trowel: if this work be done in warm weather, it will dry sooner, which will be an advantage; and if a superior floor be wanted for better apartments, cover this first layer with another made of the lime of ragstones, well tempered with whites of eggs, and laid on about half an inch thick, before the first floor be too dry. When the whole is thoroughly dried, and rubbed with a little oil, it will be as smooth as polished marble.

Mortise and **Tenon**, a method of joining two timbers by cutting a hollow prism or recess from a face near the end of one of the timbers, and a corresponding projection at the end of the other.

Mosaic, (Gr.) or *Musaic*, a kind of painting composed of small cubes of glass, stone, wood, &c. and worked on walls, ceilings, pavements, &c. A great number of these works have been discovered amongst the ruins of antiquity. Several copies of Mosaic ornaments are given in the plates of the article *Roman Ornament*. This kind of work is supposed to have originated in the East, to have been brought from Phœnicia to Greece, and from thence to have passed to Rome. The most curious and valuable works, which contain figures and explanations of antique Mosaics, are *Barthelemy*, Explication de la Mosaïque de Palæstrine; *Savorelli* and *Capellani*, Opus Musivum erutum ex Ruderibus Villæ Hadriani; *Hæffelin*, Observations sur la Mosaïque des Anciens, á l'occasion de quelques Tableaux en Mosaïque, qui se trouvent á la Galerie des Peintures de l'Electeur Palatin, in the comment. Hist. Acad. Theodoro Palatinæ, vol. vi; Osservazioni di *Ennio-Quirino Visconti*, su due Musaïci antichi storiati; Description de la Mosaïque, trouvée á Séville, published by order of the king of Spain; *La Borde*, Mosaïque d'Italica, published in 1802, and the best collection we know of; *Ciampini*, on the Mosaics of Sacred and Profane Buildings, published in 2 folio vols. at Rome, in 1690, 1699; *Furietti*, on Mosaics; *M. de Vielle*, Essai sur la Peinture en Mosaïque. Several other works of the same kind might be enumerated.

Mosque, (Arab.) a Mahometan temple, or place of worship. The earliest Arabian mosques enclosed in a quadrangular square an immense number of columns ranged in rows, which were often the rich spoils of ancient edifices. The mosques of the Turks, on the other hand, are more distinguished for the size and elevation of their principal cupolas. Each mosque has its minaret, and commonly a fountain of water, with numerous basins for ablutions. See *Arabian Architecture* and *Constantinople*.

Mould, called also *Caliber*, an instrument of iron or of hard wood, used by masons as a guage to give the dimensions and form of carved stone-work in cornice.

Mouldings, the small projecting ornaments of columns, &c. The regular mouldings are, *the fillet*, *listel*, or *annulet*; the *astragal*, or *bead*; the *torus*; the *scotia*, or *trochilus*; the *echinus*, *ovolo*, or *quarter round*; the *cyma reversa*, *inverted cyma*, or *ogee*; the *cyma recta*: the *cavetto*, or *hollow*. A more particular description of each will be found under their several articles. Their forms and application are exhibited in *Plates* M 3, M 4, and M 5. The Greek mouldings are chiefly distinguished from the Roman, by being composed of ellipses, and other conic sections, while the Roman are formed of segments of circles. The Roman ovolo and cavetto are never found in Grecian architecture, nor the Greek echinus in the Roman. In some early specimens of the Doric, a straight line is used instead of the moulding, as in the capital of the portico of Philip at Delos. All, except the fillet, admit of decoration; but in the richest profile it is advisable to leave some uncarved, to give a due repose to the composition, and to prevent confusion. The fillet may be used at all situations, and heights. The torus is appropriated to bases. The scotia should be below the eye, and between the fillets attached to the torus. The echinus serves for supports, and should only occupy situations above the eye. The inverted cyma is also used as a supporting member. The cyma recta and cavetto are only fit for crowning mouldings, for which their forms are peculiarly adapted, being incapable of holding water, which must necessarily drop from their extreme points.

An assemblage of essential parts and mouldings is termed a profile, and on the choice, disposition, and proportion of these depends the beauty or deformity of the profile. The most perfect are such as are composed of few mouldings, varied both in form and size, fitly applied with regard to their uses, and so disposed, that the straight and curved ones succeed each other alternately. On every profile there should be a predominant member, to which all the others ought to be subservient, and seem made either to support, to fortify, or to shelter it from the injury of the weather, as in a cornice when the corona is principal, the cyma or cavetto over it, and the modillions, dentils, ovolo, and talon, support it.

Movenaw, a small flat bastion, in the middle of a courtin of unusual length; intended to be occupied by a band of musqueteers for the defence of a fortress.

Mullions, the frame-work of a Gothic window.

Multilateral, (Lat.) having many sides.

Muniment-room, a little strong room or apartment for keeping plate, charters, evidences, &c.

Munnions, another name for *Mullions*.

Mural, (Lat.) belonging to a wall.

Museum, (Gr.) a repository of scientific and literary curiosities, and the works of learned men and of artists

This term was originally applied to that part of the palace of Alexandria which was appropriated solely to the purpose of affording an asylum for learned men: it contained groves, and buildings worthy of royal majesty, and a temple, where the body of Alexander was deposited in a golden coffin. Men of learning were here lodged, and accommodated with large halls for literary conversations, and porticos and shady walks; and, supplied with every necessary, they devoted themselves entirely to study. They were divided into companies, or colleges, according to the sciences of which they were professors; and to each of these was allotted a handsome revenue. The foundation of this establishment is attributed to Ptolemy Philadelphus, who here placed his library.

Of museums, in the modern sense, Professor Beckman says, that anciently natural curiosities were preserved in wax; and dead bodies also, both in wax and honey. In the middle ages, particular and extraordinary articles were dried, and kept in the treasuries of emperors, kings, and princes, which gradually increased into menageries, and probably museums. Such collections were first made by private persons, in places where many families had been enriched, without much labour, by trade and manufactures. They appeared for the first time in the 16th century, and were formed by every learned man who studied natural history.

Of Museums in this country, the Ashmolean at Oxford is a noble pile of building, erected at the expense of the University, at the west end of the theatre, on which side it has a magnificent portal, sustained by pillars of the Corinthian order. The front, which is to the street, extends about 60 feet. It was begun in 1679, and finished in 1683; when a valuable collection of curiosities was presented to it by Elias Ashmole, Esq., which were the same day deposited there. Important additions have been since made to this collection; among which are Egyptian antiquities, hieroglyphics, and mummies; with Roman altars, and medals and lamps, and various natural and antiquarian curiosities.

The British Museum occupies an ancient building of great extent, erected by the first Duke of Montagu, and formerly called Montagu House. This erection is in the French style of architecture, and has behind it a garden, consisting of nearly nine acres of ground. It was purchased of the Duke's heirs, by parliament, for uniting together the Royal, Cottonian, Harleian, Sloanian, and other collections of books, manuscripts, coins, subjects of natural history, and other articles of great rarity and value.

On the western side of this building is the entrance, under tall arches, leading to the various apartments. The staircase and ceilings are ornamented by the artists Baptiste, Rousseau, and La Fosse. Among these works are Cæsar, attended by the chiefs of the provinces he conquered; the feasts and sacrifices of Bacchus; and an emblematical representation of the rivers Nile and Tiber. On the ceiling, Phaeton, accompanied by the Hours, in the ardour of youthful enthusiasm, undertaking to guide the chariot of the sun; and the story is continued to the ceiling of the first apartment. A fine portrait of Sir William Hamilton is placed over the north door leading to the saloon, and the adjoining room contains several valuable portraits. On the ceiling of the first room on the first floor, which is a half-oval, is a very fine painting of Jupiter hurling the lightning at Phaeton. An innumerable variety of Egyptian, Greek, Roman, and Indian antiquities, are deposited in the various apartments; and models, and sculptures, and singular devices, with natural and artificial curiosities; ancient armour; with Otaheitan and South Sea implements; a great variety of birds and beasts, with minerals, fossils, shells, petrifactions, reptiles; and in the great Hall, ancient coffins, fragments of columns, Roman statuary, and Egyptian tombs covered with hieroglyphics. The royal library, presented by his late Majesty, George the Fourth, occupies a magnificent room built for their reception.

Mutatorium Cæsaris, was, according to Ruffinus and Victor, a mansion in the first quarter, by the Capene gate, which was inhabited by Cæsar during his high-pontificate.

Mutule, (Lat.) a projecting ornament of the Doric cornice, which occupies the place of the modillion in the other order, and supposed to represent the ends of rafters.—As mutules had their origin from imitating the ends of wooden rafters, they are properly represented with a declination towards the front of the corona.

Mycenæ, a very ancient city of Greece, the remains of which are described in the articles *Acropolis*, *Arch*, and *Cyclopean Buildings*. In Plate *Acropolis, Tiryns, Mycenæ, fig.* VIII is a view of the postern gate of the Acropolis, and *fig.* IX. the gate of the Lions. In Plate *History of Arch*, are given a view of the interior of the Treasury of Atreus, a plan, and at the bottom of the plate, a view of the entrance from the outside, in which is represented, on the ground, in the situation in which it was found, a very singular capital of great antiquity. A plan of the Acropolis, and other details, are given by Gell, in his "Itinerary of Greece."

N.

Nails, (*nægl*, Sax.) small spikes of metal, to fasten parts together. Sir W. Gell has given figures of the round-headed bronze nails, which he found in the treasury of Atreus, at Mycenæ, which were made of copper and tin, in a proportion of 88 to 12. Bronze nails were used, according to Winckelmann, in the bronze doors at Herculaneum. The heads of those in the doors of the Pantheon, are five inches in diameter. These kinds of nails were called *clavi capitati*: Philander and others think they are the *clavi muscarii* of Vitruvius. The head of a bronze nail in the cabinet of the Roman college has nearly the figure of a parasol, or mushroom: the length of the square tail of the nail is engraved with many characters, upon one side is ΑΩ ΣΑΒΑΘΩ. Winckelmann mentions a bronze nail with a fly sculptured in relief. Some of these circumstances must have given rise to the term (*muscarii.*) There were also nails called *bullæ*, from the resemblance of the head to those ornaments, and their large gilt heads added much to the grandeur of the doors of the temples, &c. From Plautus it appears, that they were used in doors of common houses, and great pains taken to keep them bright. (Plaut. Asin. ii. 4. 20.—See Cicero. in Verr. iv. 56.) Pliny mentions a kind of bituminous earth, used by the blacksmiths for colouring the heads of nails, (lib. xxxv. c. 15.) Iron nails, with flat heads, have been found in British barrows, from half an inch to five inches long. (Hoare's Ancient Wilts.)

The different kinds and names of modern nails are very numerous. *Back nails*, have flat shanks, that they may not open the wood: *clasp nails*, or *brads*, have flat heads: *clench nails*, are principally used by boat-builders, &c.: *dog nails*, are used to fasten hinges to doors: *rose nails*, are drawn square in the shank: *scupper nails*, are for nailing canvass to wood: *square nails*, are for hard wood: *tacks*, are used for fixing paper, &c. on wood, and the larger kind, by upholsterers, &c. Other kinds, such as *deck nails*, *port nails*, &c. are used by ship-builders. *Clout nails*, are generally used to nail clouts to axle-trees, and fixing iron-work, and have flat heads. See *Adhesion.*

Naked, a term applied in architecture either to a column or a wall, to denote the face or plain surface from which the projections rise.

Naked Flooring, the framing of one or more rows of equidistant beams of timber in horizontal planes, for supporting the boarding. The timbers are called *joists*, and other strong beams, called *girders*, are sometimes introduced. The joists have different names, according to the situation in which they are placed. *Single* or *common joists*, are employed in the construction of common floors, which consist only of one row. *Binding joists*, are employed in the best description of floors, along with other joints, called *bridging* *joists* and *ceiling joists*, which altogether make a grated frame of timber-work: the binding joists, which are the strongest timbers, are placed in the middle row, with the bridging joists above, and the ceiling joists below, and support both. The bridging joists are notched a certain portion of thin depths upon the binding joists, and the ceiling joists are generally done in the same manner: the notches, to preserve the strength of the binding joists, are only cut from the edges, but in the bridging joists the notch is cut through the entire thickness. In floors of great extent, girders are introduced, and the binding joists are framed into each side of the girder: the top of the girder is generally below the level of the top of the bridging joists. The ceiling joists are generally nailed up to the under side of the binding joists, forming by their under edges a level surface for nailing the lath, which is to sustain the plastering of the ceiling. Binding joists are placed at the distance of about four feet six inches clear, bridging joists one foot, and ceiling joists about fourteen inches. On the subject of *Naked Flooring*, may be consulted Wallis's Opera Mathematica, vol. i. prop. x. chap. 6. and Godfrey Richards' Palladio. It is not now in much use. See *Carpentry*.

Naos, (ναος, Gr.) the enclosed apartment of an ancient temple, before which stood the *pronaos*, and behind it the *posticum*.

Natural Beds, the surfaces of a stone from which the laminæ were separated.

Naumachia, (Lat. from ναυς, *a ship*, and μαχη, *a battle*, Gr.) originally a show exhibiting a naval fight, and applied in a secondary sense to the circus in which this kind of spectacle was exhibited, which was surrounded with seats, the pit being filled with water by means of pipes. At Rome were several naumachia, built by Augustus, Claudian, and Domitian.

Nave, (*naf*, Sax. from ναος, *a temple*,) the middle part of a church. Naves of churches extend from the west end of the choir or chancel. In great churches they contain numerous small altars placed between or against the columns, very rarely monuments. The centre and side aisles were left free. The top of the middle aisle, with windows above the arches, is called the *clere-story*. Some have compared the form of the Christian churches with nave and aisles to the hypæthral temples of the ancients, in the cella of which a row of columns down each side separated the sides from the centre. The Egyptian temples of Hermontis and Ybsambul, are separated by two rows of piers or pillars, into three alleys. A similar disposition was observed in the Roman basilicæ. (Architectural Notes on German Churches.) In English churches the nave belongs to the parishioners, whose business it is to keep it in repair.

Naval Architecture. Navigation is believed to have been carried on at a very early period, and to a great extent, by the Phœnicians: and the materials of the first ships were probably procured from the woods of Libanus. Some imagine that the first hint for the shape of boats, and larger vessels, was taken from the flight of the kite; others, as Oppian (De Piscibus, lib. i.) from the nautilus; and others assert that it must have been accidental: however, it seems more probable that they were made in imitation of that vessel, which is recorded to have saved Noah and his family from the destruction of the primeval world. The Greeks were never much celebrated for navigation, nor do their vessels seem to have been in general calculated for long voyages.

Ships were not in use among the Romans till the first Punic war, A.U.C 490. The description of a ship which was sunk in a naumachia, at Lake Nemi, is given by Fosbrooke, (Encycl. of Antiq.) The hull was of larch, the outer part plastered with bitumen, and over it sheets of lead fixed down with brazen nails: the inner part was covered with an incrustation of iron and clay, to preserve it from fire. The seams of the planks were caulked with tow and resinous pitch; and the name was inscribed upon a tablet, (*Ptychis*, *οφθαλμος*) nailed to the prow between two eyes, with strong beams or boards (*epotides*) on each side, to defend it from shocks against the shore, &c. The prow of ancient ships was of bronze, and had one or more beaks (*rostra*) to pierce the flanks of the enemy's ships; they were placed on the *embolum*, (*εμβολον*) or lower part of the prow. The ornament above the rostrum was called the *acrostolium*, that at the stern *cheniscus*, or goose's neck. The *aplustre* (*αφλαστα*) was an ornament resembling two wings, with a broad plate or parasol frequently attached, called *ασπιδειον* or *ασπιδισκη*. Decks, (*καταστρωματα*) the whole length of the ship were invented by the Thasians. Their place was before supplied by two scaffolds, (*παραβληματα*) one at the stern, the other at the prow. The prow was generally made in form of a fish, most commonly the dolphin. The was generally directed by a person called *celeustes*, who gave the signal for the rowers to strike, and sung the *celeusma*, or song of encouragement, in which they joined. In the middle was the commander of the rowers, called *hortator remigium*, *pausarius*, or *portisculus*. Sails are said to have been the invention of Æolus or Dædalus. According to Pliny, they were placed at first one above another, on the same mast; but afterwards at the stern and prow. The sails at the stern were called *epidromus*, at the prow *dolones*, at the top of the mast *thoracium*, that put at the end of another *orthiax*, and that on the main mast *artemon*. Both sails and oars were used in the same vessel. Masts are mentioned by Homer, but not fixed. At the prow was a kind of bowsprit. The *κεραιαι*, or *asseres*, were large beams, with iron at both ends, suspended like the yards, and in battle were swung like battering rams at the enemy's vessel. There were tops as now to the masts, called *corbes*, manned by soldiers, and by *corbitores*, who were to watch the enemy's motions. The ship took its name from the *parasema* or symbol, which was placed at the prow. At the stern, the protecting deity had her statue and altar. On the edges was a piece of wood called *chelysma*, to defend the deck. Ancient ships had wells, and conservatories of water; the well was emptied in some instances by the *antlia* or pump, in others by the winding screw of Archimedes. The dock for ships is the *textrinum* of Servius, Papias, &c. The *navalia*, in Greece were the towns built about the port of a more important town, when that town was too far from the sea to have a harbour of its own: at Rome the term was applied to quays, where ships unloaded their goods.—The following are the principal kinds of ships mentioned by ancient writers. *Actuariæ naves*, long and light, with oars and sails. *Annotinæ. Frumentariæ*, provision vessels. (Pollux.) *Hornotinæ*, those built in a year. *Candicariæ*, those used on the Tiber, made of thick planks. *Constratæ*, those wholly decked. *Cubiculatæ*, such as contained different apartments, like a house. *Lentriæ*, *pontones fluviatiles*, those employed only on rivers. *Levibus*, light and undecked. *Liburnæ*, light gallies, with sails and oars. *Lintres*, (*μονοξυλα*) canoes made out of the trunk of a tree, carrying three men. *Leves*, very light, undecked. *Longæ*, *militares*, such as carried a large number of men, with oars. *Lusoria*, pleasure boats. *Moneres*, *monocrata*, vessels with only one rank of oars, galleys. *Onerariæ*, ships of burden, with sails and oars. *Orariæ*, *littorariæ*, *trabules*, coasters. *Plicatiles*, made of wood and leather, so to be taken to pieces, and carried about. *Præcursoriæ*, such as preceded the fleet. *Prædatoriæ*, *prædaticæ*, long swift pirate ships. *Solutiles*, those intended to fall in pieces, as that in which Agrippina was exposed. *Stationariæ*, such as remained fixed at anchor. *Sutiles*, made of staves, and covered with leather. *Trabariæ*, light barks, (Pollux.) *Gauli*, Phœnician, round for carriage. *Corbitæ*, with tops to the mast, without oars. *Caudicæ*, corn vessels. *Cercuri*, ships of burden, sails and oars. *Celoces*, *celetes*, pirate vessels, without decks. *Catascopia*, brigantines, (Gellius.) *Hippagines*, or *hippagogæ*, for carrying cavalry, (Liv. 44. 28.) *Oriæ*, wherries, (Plautus.) *Lenunculi*, small fishing boats, (Nonnus.) *Horiolæ*, the same, *Stlatæ*, piratic vessels, broader than high. *Pontones*, ferry boats. *Phaselus*, a small vessel with oars and sails. *Paro*, *parunculus*, a bark. *Myopara*, a Corsair's vessel, (Plautus, Festus, &c.)

Amongst the machines used in ancient sea-fights may be enumerated the *dolphin*, (*δολφιν*) a large piece of lead or iron, in the form of that fish, which was suspended to the masts, and thrown with force into the enemy's vessel: the *drepanum*, (*δρεπανον*) in form of a sickle, fixed on a long pole, to cut asunder the ropes of the sail-yards, &c.: *the naval spears*, (*δορα τα ναυμαχα*) which were of an extraordinary length, and are called by Homer, (Il. xv.) *μακρα*: the *ciraiæ*, (*κιραιαι*) machines to throw large stones: *corvi*, or grappling-iron, &c.

The only specimens that are known of ancient British shipping are the *coracles*, still used in Wales, which are round wicker baskets. The British ships are supposed to have been of the same form as the Phœnician, which were nearly round. The ships of the Anglo-Saxons were often richly ornamented: the keel ran broader and broader from the stern to the prow, when it again decreased gradually to a point, the more readily to cut the water. Harold sent, as a present to Athelstan, a magnificent ship, with a golden beak and purple sails, surrounded with shields, gilt in the inside. The Anglo-Saxons had also *pleg-scips*, i. e. play-ships, supposed to be pleasure vessels. In Lye, occur *scip-hlædder*, (ship-ladder,) *scip-hlaford*, (ship lord or captain,) *scip-rother*, (a rudder,) the *ceola*, (a ship with deck and cabin,) *roge-streng*, (cord which bound the sail to the mast,) *mæst-cyst*, (hole to receive the mast,) *mæst-rap*, (mast-rope,) and *fot-rap*, (rope at the foot or bottom of the sail.) The Danish ships appear in general to have been only a kind of very large barks, with several rows of oars; and the large vessels said to have been built by some of their kings, were more for show than use. In the middle ages, the term *archinale*, called also *tarsenatus*, was applied to a place appropriated both to the building of ships, and keeping of arms. Among the vessels of the middle ages, we find mentioned the *alnus cavata*, by Fridegodus, in his Life of Wilfrid, the character of which may be conjectured from its name, the *busse*, a ship made like a wine-cask, and the *abromones*, used in rowing matches: the *gondola*, from the barbarous Greek, κουντελας, a Venetian ship, *radæ*, ships with wooden towers. The *lin*, sailed with all winds without danger, the *lymphad* had one mast, the *letter of marque*, first mentioned in the time of Richard II. In the fifteenth century, *ships of forecastle*, the largest in use, carried about 150 men, *barges* about 80, a *balinger* 40, a *spinne* or *pinnace* 25.

There are few accounts of the state of the English navy before the time of Henry VIII. In Rymer's Fœdera, vol. viii. p. 447, is an order to Henry Somer, keeper of the private wardrobe in the Tower, to deliver to Mr. Loveney, treasurer of queen Philippa of Sweden, (who was then sent to her husband by her uncle, Henry IV. in the ship called the Queen's Hall,) the following military stores: — "eleven guns, forty *libras pulveris* pro gunnes, forty *petras* pro gunnes, forty tampons, four touches, one mallet, two fire pans, forty pavys, twenty-four bows, forty sheaves of arrows, pro stuffura ejusdem navis, ordinata pro aula ejusdem reginæ." This is believed to be the first document of the kind, and is curious, as it mentions cannon employed on board a ship. Henry V. and Edward IV. appear to have had several ships of their own, which were sometimes used in war, and sometimes in trade; and in 1481, the latter issued an order "dilecto sibi Richardo Symondes, magistro navis nostræ vocatæ *Le Grace de Dieu*," in which is set forth "cum nos quandum armatam potentiam ad profisciscendum supra mare in resistentiam illius infidelis et antiqui inimici nostri regis *Scotorum* ordinavimus, assignavimus te ad tot marinarios quot pro gubernatione et conductione navis prædictæ necessarii fuerint et opportuni, ubicunque inveniri poterunt, tam infra libertates quam extra, arestandum et capiendum, et eos in nave prædicta, nobis ad vadia nostra deservituros, ponendum et poni faciendum." Similar orders were directed to the captains of five other royal ships, and also to five ships not belonging to the king, which seem to have been hired. At this time the ships appear to have been built much larger than in the preceding reigns, for in the famous armada of Edward III., though it consisted of 1100 vessels, the men on board were only 11166, allowing very little more than ten men for a vessel.

Before the reign of Henry VIII., there appears to have been no regular navy. Ships were occasionally hired from the Venetians, Genoese, &c. which with those supplied by the Cinque Ports, formed the whole English fleet, and were all dismissed as soon as the service was performed, for which they were hired. Henry found the inconvenience of having suddenly to raise so large a fleet as was required by his wars on the continent, and, to execute his plan of forming an established navy, he established building yards at Woolwich, Deptford, and Chatham. The following extract from a report made to James I. in 1618, will show the state of the navy till the time of Elizabeth. "In former times our kings have enlarged their domisions rather by land than sea forces, whereat even strangers have marvelled, considering the many advantages of a navy; but since the change of weapons and fight, Henry VIII. making use of *Italian shipwrights*, and encouraging his own people to build strong ships of war to carry great ordnance, by that means established a puissant navy, which in the end of his reign consisted of seventy vessels, whereof thirty were ships of burden, and contained in all 10,560 tons, and two galleys; the rest were small barks and row-barges from eighty tons downwards to fifteen tons, which served in rivers, and for landing of men. Edward VI., in the sixth year of his reign, had but fifty-three ships, containing in all 11,005 tons, with 7,995 men, whereof only twenty-eight vessels were above eighty tons each. Queen Mary had but forty-six of all sorts." The shape, however, of the ships of these reigns were, perhaps, more contemptible than their size and number. The Harry Grace de Dieu, the largest of king Henry's fleet, if we may depend on the curious print given us by Mr. Topham, may be fairly pronounced unfit for every purpose of navigation. Another print of a large ship, published by Mr. Allen, and supposed to have been built in James's reign, is less uncouth, though still an unpleasant picture of the state of ship-building at this time. However, in a few years the art was astonishingly improved, and the Royal Sovereign, built in 1639, gives us the first idea of any knowledge of the art, and she continued a useful and valuable ship in our navy, until the beginning of the last century, being in all the actions at sea, during the reigns of Charles II. and William III., and doing great service in the fight off La Hogue, in 1692. The number of the navy was greatly increased by Elizabeth, but declined during the reign of James I. and his successor Charles, and was not much increased during the time of Cromwell; but the navy flourished greatly in the reign of Charles II., and has continued to increase progressively in number and power, till the present time. (See Willett, on British Naval Architecture, in the eleventh volume of the Archæologia.)

Nebule, (*nebula*, Lat. *a cloud*,) in Saxon and Norman architecture, a zigzag moulding without angles.

Neck, the space between the cannelures and annulets of the Doric capital, in Grecian examples; and in Roman, that between the astragal and the annulet. It is seldom found in the Ionic, but it occurs in the capitals of the temples of Erechtheus and Minerva Polias, at Athens.

Neck-mould, in Gothic Architecture, the moulding which separates the capital from the shaft, or that under the finial of a pinnacle or canopy.

Neefs, Peter, an architectural painter, born at Antwerp in 1570. He was a disciple of Henry Steenwick, and was particularly skilful in perspective, generally choosing subjects which displayed that science. His son Peter succeeded, but never equalled him, in practising the art. Peter Neefs died at the age of eighty-one.

Nemea, a town of ancient Greece, which was celebrated for its magnificent temple of Jupiter, surrounded by a grove of cypress. In Pausanias' time the roof was already destroyed. The ruins of the temple of Jupiter Nemea still exist. They consist of three Doric columns, two of which support their architrave. The temple was about

188 feet 3 inches long, if there were fourteen columns in the flanks, as Mr. Wilkins supposes. The breadth of the upper step was 65 feet 3 inches. There were six columns in front. The width of the cella was 30 feet 7 inches. The length of the temple between the column of the pronaos and posticum was 105 feet 2 inches. The diameters of the columns of the peristyle 5 feet 2¼ inches. Upper diameter of the columns 4 feet 3½ inches. Height of columns 31 feet 10¾ inches. Capital 2 feet ⅜ inch. Diameter of columns of pronaos 4 feet 6⅛ inches. Whole height of entablature 8 feet 1¾ inches. Height of the three steps 3 feet 6¼ inches. General intercolumniation 7 feet ⅜ inch. Angular intercolumniation 5 feet 10¼ inches. The columns are higher in proportion to their diameters than is usual in the Doric order, and lose much of their effect: the capital is mean. The ruins of the temple are heaped in confusion round the columns which remain standing. To the south is a tumulus, with a Greek chapel upon it, in which are the fragments of a small Doric temple. Gell has given a view of the ruins of the large temple. See Gell's *Itinerary of Greece*, p. 22. Wilkin's Introduction to his *Magna Græcia*.

NEMI, *Lake of*, in Italy. Trajan erected a palace, or ship, in the centre of this lake, which was more than 500 feet long, 270 broad, and 60 high, built of the most solid wood, fastened with bronze and iron nails, and covered with plates of lead, which were double in places exposed to the action of the water. It was lined within with marble, or a composition resembling it. Its ceilings were supported by beams of brass, and it was supplied by means of pipes with the pure water of the fountain Egeria. It was moored in the centre of the lake, and appeared like an enchanted castle. When it sunk is not known, but it was probably neglected, and appears to have disappeared before the invasion of the barbarians. Marchi, a learned and ingenious Roman, descended in a diving machine in 1533, and made such observations as enabled him to give a long and satisfactory description of it. It is much to be lamented that no attempt has been made to raise it. Many ancient ruins are found on the banks of the lake. See Brotier's Suppl. to Tacitus. Eustace, vol. ii. p. 272. Miss Knight's Latium, 87 – 907.

NERVES, the mouldings of the ribs of Gothic groins.

NESSOTROPHIUM, (Gr.) a place in the Roman villas for breeding ducks.

NET, or RETE, (*net*, Sax. *nati*, Gothic,) the covering of a geometrical solid.

NET MEASURE, a term used when no allowance is made for finishing, in buildings, or for waste of materials.

NEWEL, the upright cylinder or pillar, around which winding stairs turn, thence called *newel stairs*.

NICHE, (from the Ital. *nicchio*,) a cavity or hollow in a wall, for the reception of a statue, &c. They are found sometimes square in ancient buildings. Niches are seldom found in pure Grecian buildings, except when they have been afterwards made by the Romans. Those in the Pantheon at Rome, are rectangular recesses, dressed in the same manner as the apertures of doors. The exedræ or large niches on the sides, have cylindrical backs, finishing at the top with the soffit of the architrave of the general entablature. A niche, on a circular plan, is observed in the remains of the piazza of Nerva, with a rectangular front and circular head. Various kinds of niches are found in the ruins of Palmyra and Balbek, many of them richly decorated. An inscription published in the *Monumenti Gabini*, shows, according to Visconti, that the ancients called niches *zothicæ*. In Roman buildings, niches are generally unornamented, but in the Gothic style they are highly enriched. Niches are made to partake of all the segments under a simicircle. Great care should be taken to proportion them to the size of the figures which are intended to occupy them. An *angular niche* is one formed in the corner of a building; a *ground niche* has its rise from the ground, as in the portico of the Pantheon at Rome. For the construction of niches, see *Carpentry*, *Constructive Carpentry*, *Descriptive Carpentry*.

Nicomedes, a Greek geometrician, who flourished, probably, near the time of Eratosthenes, and is celebrated as the inventor of the *conchoid*.

Nidged Ashlar, is brought to the square by means of a cavil or hammer with a sharp point, and is used in Aberdeen when the stone is so bad as to resist the mallet and chisel. See *Ashlar*.

Nilometer, an instrument used in Egypt to measure the increase of the Nile.

Nineveh. Diodorus and Strabo think this to have been the largest town ever known. It is now entirely destroyed, but is believed to have been situated on the bank of the Tigris, opposite the place where Mousul stands. Jardine told Evelyn (Evelyn's Memoirs, i. 491) that Nineveh was a vast city, now all buried in ruins, the inhabitants building in the subterraneous vaults, which were, as appeared, the first stories of the old city, and that there were frequently found huge vases of fine earth, columns, and other antiques. In the "Description du Pachalik de Bagdad," (Paris, 1809,) ruins of the old city are said still to remain.

Nismes, see *Amphitheatre* and *Maison Carrée*.

Nodated Hyperbola, a name given by Sir Isaac Newton to a hyperbola, which in turning round decussates or crosses itself.

Nogs, a term used in Lancashire for *wood bricks*.

Nogging, a kind of brick work carried up in panels between quarters. The horizontal boards which are nailed to the quarters to strengthen the brick work, are termed *Nogging-pieces*.

Nonagon, (Gr.) a figure of nine sides and nine angles.

Normal Line, a line which intersects another at right angles.

Norman Architecture. After the fall of the Roman power, the first people who occupied the west of Europe were the Goths, who, under Theodoric, gained possession of Italy about 493. Their buildings were principally castles or palaces, and were characterized by excessively rude heavy walls, blended with the decorative materials they robbed from the remains of the Roman edifices, which they piled together without regard to order or symmetry: remains of their buildings are still found in many parts of Italy. The Goths were succeeded, about 568, by the Lombards, who, in their first attempts at architecture, merely imitated the works of their predecessors. Their edifices were merely composed of immense solid walls, from six to nine feet thick, with narrow windows, or rather loop-holes, for discharging missiles on their assailants, and at the same time to screen the besiegers from the aim of the archers without. When the Lombards were united under one government in 590, their queen Theodolinda embraced the Catholic faith, and endowed numerous ecclesiastical establishments. The style of their castles was naturally transferred to their churches, which had the same massive proportions, and narrow windows, though the latter were somewhat larger, and round-arched at the top. This mode of construction predominated even after the reign of Charlemagne, who expelled the Lombards in 778, and became, with various improvements, the prevailing style through Italy, Germany, and France, under the appellation of the Lombard style. Bede, Spondani, and Felibien, described their religious buildings as most magnificent, but it was only such magnificence as agreed with the time.

On the cession of Normandy, (then called Neustria,) to the Normans by Charles the Simple, in 912, and their conversion to Christianity, they strove to exhibit their zeal in the new faith they had adopted, by the extent and splendour of their ecclesiastical buildings. The Norman monks were so partial for architecture, that they studied both the theory and practice; in their own structures they worked as artificers and masons, the most intelligent superintending and directing the execution of plans, that were designed by the abbots and superiors. They adopted the heavy style of the Lombards, but on a grander and more noble scale, adding numerous ornamental accessories of their own invention. The similarity of the first Norman style to that of the Lombards, has caused it to be included in France under the same name, and it was not until the eleventh century that it was eminently distinguished. Remains of the architecture of this period are found in abundance in Normandy; till at the commencement of the twelfth century it gave way to the Gothic.

The form adopted by the Normans in their religious structures was that of all the Christian churches of the middle ages, as described by Gregory of Tours—oblong; in form of a Latin cross; with a semicircular chancel; in the interior was a nave and two aisles, which were separated by arcades of round arches; and underneath was frequently a crypt; the whole externally supported by small buttresses. The ornaments were chiefly used in the doorways and windows, and also in the cornices, which generally consisted of ornamental mouldings: the ornaments are chiefly taken from the architecture of the different people whom they succeeded, and differ only in their combinations; the most frequent is the chevron or zig-zag. A more full description of these ornaments will be given under the article *Saxon Architecture*. In the latter periods of Norman building, the pine cone, the simple and double, astreated, diamond, platted, and the beak or cat-head mouldings, are of frequent use, the latter representing the heads of cats or birds, surmounting a plain thick semicircular band, overlapped by the tongues of the former, or by the beaks of the latter. The columns had no diminution, were at first but rude cylinders, and were afterwards ornamented by angular mouldings, bands entwining from the base to the capital, smaller columns grouped around, &c. and, like the columns of many of the Egyptian temples, each column of an arcade, &c. differed in its shape and ornaments from all the others;

the capitals at first large, square, and heavy, sometimes ornamented with grotesque monsters, ugly and often obscene figures of animals and human forms, were afterwards adorned with rude imitations of Roman work, such as bands, volutes, and foliage. The doorways and windows were deep, on account of the excessive thickness of the walls, and were always surmounted with a semicircular arch. They were at first very small, but towards the middle of the eleventh century they began to be enlarged, and to be more richly ornamented; and in the latter end of this century, and the beginning of the twelfth, the columns, piers, arches, &c. of the doorways were most elaborately worked, and ornamented with statues of saints, &c. and the pediment commonly adorned with ecclesiastical sculptures. In the first period, double windows, or two smaller ones, included within one larger one, supported by plain short rude pillars, were in use, and, in the second period, triple windows, or one high central one with a smaller one on each side, with ornamental and slender pillars, were introduced. The upper row of windows were much smaller, in general, than the lower ones. False windows were often used for ornament in the latter period. Modillions or corbels were much used by the Normans; they were at first very clumsy, and had a very considerable projection, supporting a heavy flat cornice, and ornamented at the ends with grotesque figures. Afterwards they were made smaller, and had heads only at the ends; and at the end of the eleventh century they were made plain, and supported only one row of arches, and sometimes only a very small cornice ledge, or a narrow band in form of the edge of a saw. Towers were at first square, plain, and of little elevation; but they were by degrees made higher, and more ornamented, with false windows, intersecting arches, and pyramidal pinnacles. The best specimens of Norman buildings are found at Caen, Bayeux, and Valognes, and other parts of Normandy; the church of Lessay, in the department of La Manche, which was founded about the period of the conquest of England by William, is the most perfect specimen known, being entirely unmixed with later Gothic additions.

When the Normans gained a settlement in England, they at the same time secured their conquests by building an immense number of fortresses, and signalized their zeal in religion, by the number and magnificence of their ecclesiastical edifices. The term Anglo-Norman may be applied to all buildings erected in the reigns of William I. and II., Henry I., Stephen, and Henry II., or from 1066 to 1189. Some writers have, from the similarity of the two styles, included the arches of the Saxon builders under the same term; and it has been doubted, whether any genuine Saxon buildings yet remain. (See *Saxon Architecture.*) The Normans either altered or rebuilt almost every ecclesiastical edifice they found. Perhaps one of the earliest specimens is the ruins of Lindisfarne, the monastery of which was certainly originally a Saxon building.

Lindisfarne was called by the Britons *Inis Medicante*, and by the English *Holy Island*, from being the residence of several of the fathers of the Saxon church. King Oswald, in 635, made it a bishop's see, and Aiden, a Scot, its first prelate. The church was enlarged in

659, but, "*more Scottorum,*" only made of timber, and thatched. Eadbert, who was bishop about ten years, and died in 698, covered all the roof and walls with sheets of lead. The Danes made their second descent on this island in 875, when Eardulf, the seventeenth and last of its bishops, with Eadred, the abbot of the monastery, and the inhabitants of the island, took up the body of St. Cuthbert, and the most valuable of their relics and sacred utensils, and, after wandering from one hiding place to another, for seven years, from fear of their pagan invaders, they at last settled at Chester-le-street, where eight bishops presided, till the final removal of the see to Durham. The monastery was given by William de Carilepho to that of Durham. "The church of the monastery," say the writers of the Beauties of England and Wales, "is now in ruins. Its north and south wall is standing, though much out of perpendicular; great part of the west remains, but the east is fallen. All the roof, both of the church and chancel, has been arched. The columns of the nave are of four sorts, twelve feet high, and five feet in diameter, massy, and richer than those of Durham; the bases and capitals are plain. Over each arch are large windows, in pairs, separated by a short column; and over these are smaller arches. One of the diagonal ribs of the arch, that supported the tower, is still standing, richly wrought with Saxon zigzag; as is also the western door, and several other arches. The length of the body is 138 feet, its breadth 18 feet, and, with the two aisles, 36 feet; but it may be doubted, whether there ever was a transept."

The military buildings of the Anglo-Normans have been sufficiently described under the article *Castle*: in the present we shall confine ourselves principally to the style of their ecclesiastical works. The rage for building churches and monasteries prevailed to such a degree amongst the Norman nobles and gentlemen, according to William of Malmsbury, "that a rich man would have imagined he had lived in vain, if he had not left such an illustrious monument of his piety and munificence;" and Mr. Bentham observes, that all our cathedrals, and most of the abbey churches, were either wholly rebuilt, or else greatly improved, within less than a century after the Conquest. The buildings of the Anglo-Normans are believed to have differed from those of the Saxons in general, little more than in their increased grandeur and dimensions. The Normans dismissed much of the minute ornaments of their predecessors, but far exceeded them in the symmetry of their whole buildings. The general character of the Norman style is the uniform prevalence of the semicircular arch,—massy columns standing on a strong plinth or base, with capitals usually square, often quite plain, but sometimes ornamented with foliage, and with figures of men, animals, &c., as in the one represented in fig. 8, (plate *Castle*, C. 69); massive contours of the mouldings; walls of great thickness, without any very prominent buttresses. The principal buildings do not present a magnitudinous assemblage of small parts, but a ponderous vast whole, from which all ideas of littleness are excluded in every particular.

The arches are the primary subject of investigation in an ancient edifice. Those of the Anglo-Normans are characterized chiefly by plainness and simplicity. Such was not, however, always the case; for in many instances ornaments were bestowed with a most liberal hand. Amongst the most splendid Anglo-Norman arches of entrance, is that at the west front of Rochester castle, constructed, as is believed, after the design of Gundulph. Its numerous mouldings are all decorated with sculptures, the principal of them representing twisted branches and curled leaves, with a variety of small animals and human heads, in rich open-work. Curious specimens are also observed at Glastonbury, Malmsbury, and Castle Acre priory, Norfolk. *Fig*. 6, (plate *Castle*, C. 69,) represents the mouldings of an arch to the entrance of St. Botolph's priory, at Colchester, which was founded in the beginning of the twelfth century. The mouldings are worked in stone, and are in good preservation. The angles, which are stained red, are formed with Roman tiles, with which a great part of this curious edifice is built. They are supposed to have been taken from the ruins of some Roman building in the vicinity. The entrance is six feet eight inches wide. *Fig*. 12, (plate *Castle*, C. 66,) is a profile of the mouldings of the arch to the entrances of Colchester Castle. Mr. Millers, in his description of Ely Cathedral, characterizes the Norman arch as of "far greater amplitude than those of the Saxons—with less minute ornament, but frequently bounded by a single moulding—sometimes indeed by more, but often none at all—soffit always plain. In the second tier, there are sometimes two smaller equal arches under one larger, with a column of moderate size (or even comparativley slender) between them. In the third tier, generally three together, the middle one higher and broader than the others, and opened for a window; and all the three occupying a space equal to the span of a lower arch."

The columns are described by Mr. Millers, as "huge massive piers," consisting "sometimes, but seldom, of a simple shaft, and that cylindrical, hexagonal, or octagonal; and, in general, spirally fluted, or adorned with lozenges, net-work, &c. in alto or basso relief:—they are most frequently of a compound form; the body of the pier being sometimes of a rectilinear, sometimes of a curvilinear form; and on two or more sides of it, various portions of columns, or of flat pillars, applied to, and worked up with it—sometimes four stout round columns joined together, with or without angular parts appearing between each—or square, with a small round column at each corner—in short, the variety of form very great, and that in the same range—the capitals frequently plain—the most usual ornament is a sort of volutes; in some instances flowers, leaves, shells, human heads, or animals—they can scarcely be said to have a regular base, but stand on a strong flinth, accommodated to the shape of the pier." In plate *Castle*, c. 66, *fig*. 8, is a column of hatched work in the upper walk of the north transept of Norwich cathedral, of the beginning of the twelfth century; *fig*. 9 is another near it, nine inches in diameter: both with plain capitals. *Fig*. 10 is a capital to the entrance of Colchester castle, twelve inches deep, and 11 is a leaf of the same capital, on a larger scale. *Fig*. 5, 6, on *plate Carpentry*, xvi. are four varieties of Norman capitals, from an ancient doorway at Lincoln, about A.D. 1180.

The sculpture of the Anglo-Normans was very rude. Statues scarcely ever occur on the exterior of buildings; but pieces of sculpture in relief are very frequent, particularly over doorways. The subjects are generally scriptural or ecclesiastical figures, allegorical devices, whole figures of men and animals, masques, chimeræ, &c.

The roofs were generally vaulted with stone; the groining strong and plain, without tracery, but sometimes laced on one or both sides with a moulding. The chapel of the White Tower, in the Tower of London, is said to be the only example of original Norman vaulting in England. It is said to have been built by Gundulph, about 1078. This chapel has side aisles separated by massive Norman piers, and covered with Roman vaulting; but the central space is vaulted with a *cylindrical* stone vault, resting on the walls of the triforium; the eastern termination being coved, so as to accommodate the form to the semicircular apsis of the chapel. The upper windows let in the light through the triforium arches. A room below the chapel is vaulted in the same manner, the spaces under the side aisles being, in this story, solid wall.

The mouldings and other ornaments of the Norman buildings were the same as those in use among the Saxons, many of which, however, were discontinued. Those principally used by the former were the zigzag, the billet moulding, hatched work, intersecting arches to relieve blank walls, &c. See *Saxon Architecture*. The *corbel table*, consisted of a series of small arches, without pillars, but with heads of men and animals, serving instead of corbels, or brackets, to support them; they were placed below the parapet, projecting over the upper, and sometimes the middle tier of windows.

The style of architecture in Germany, termed by some writers Byzantine and Romanesque, corresponds with the style in England which we term Norman, though in some respects they vary considerably. Thus we never find in the German churches the ponderous cylindrical piers which occur in English buildings; the piers are not carved and channelled, except in a very few instances, as the crypt of St. Gereon; the German buildings have not the deep rich succession of mouldings to which we are accustomed in the door and pier arches, the latter being in Germany quite plain. They have not there the same extraordinary multiplicity and fantastical variety of mouldings and ornaments which so distinguishes our Norman: the beak-bead, the embattled fret, &c. are scarcely known, but the zigzag and the triple billet, are found in abundance.

The towers of Anglo-Norman structures are low, square, and massive, and were generally covered as platforms, with battlements, or plain parapet walls. Spires and pinnacles, when observed on Norman buildings, have been more modern additions. In Norman churches, where large pillars were used, the outer facings are generally composed of squared stones, laid in regular courses, and the middle filled with cement, as in the pillars at Ely, Peterborough, &c.: the same practice prevailed among the Saxons. Walls were also sometimes built in the same mode. The manner of the Norman masonry is in most cases an imitation of that of the Romans. The Roman *opus reticulatum*, or net-work, is used for filling up arches, and ornamenting frontons, as may be seen at

Lincoln, Rochester, Peterborough, Ely, &c. Mr. Essex, in his Essay on the Antiquity, &c. of Brick and Stone Buildings in England, in the fourth volume of the Archæologia, has observed, that the Normans frequently raised large buildings with pebbles only, and sometimes with pebbles intermixed with rag-stones; the angles being strengthened with square stones, about two feet high, and six or seven inches square, and tied into the wall by flat square stones, about six or seven inches thick, laid on the top of them. This appears to have been the prevailing mode of building in Cambridgeshire in the time of William Rufus, as may be seen in the church of St. Giles, Cambridge, and the tower of St. Benedict. In this kind of buildings, the walls appears to have been generally covered with plaster.

A number of varied styles are to be observed in Norman buildings of different ages, but not sufficiently distinguished to admit of a classification. Mr. Burdon, in a letter to the author of the Architectural Antiquities, thinks that *three* different styles of Norman architecture may be distinguished, which he terms the *early*, or that which began before the Conquest, and of which Waltham, Durham, &c. are specimens; the *middle*, observed in Peterborough, Malmsbury, &c.; and the *latter*, which is the style of Lincoln, the choir of Canterbury, &c. Specimens of Norman building may be seen in most of our cathedrals: the greatest parts of those of Durham, Carlisle. Chester, Peterborough, Norwich, Rochester, Chichester, Oxford, Worcester, Wells, and Hereford, the tower and transept of Winchester, the nave of Gloucester, the nave and transept of Ely, the two towers of Exeter, the middle of the west front of Lincoln, with the lower parts of the two towers, great part of the choir in Canterbury, with the two towers called St. Gregory's and St. Anselm's, and the north-west tower, are all of this style. A great abundance of specimens are found in the parish churches, and monastic ruins, in every part of the kingdom.

Nosings, the parts of the tread-board of steps, which project over the riser, and are generally rounded.

Notch-board, a board which is grooved or notched for the reception and support of the ends of steps in a staircase.

Notching, a hollow cut from one of the faces of a piece of timber, generally of a rectangular form.

Nubian Architecture. The antiquities of Nubia are in reality but a continuation of those of Egypt, their origin and style being decidedly the same. On the island of Philæ is a magnificent temple, which occupies an area of about 435 feet in length, and 105 wide. The propylon or pylône is 90 feet high, and resembles somewhat that of Edfou. The approach is by a long narrow court, at the entrance of which are substructions of a small temple, which had six columns on each side, and four on each extremity. From this spot a colonnade, in continuation of the columns of the temple, extended for 240 feet along the edge of the river, to the grand propylon; thirty-two columns are still standing. See *Temple*. Our plate represents an elevation of the plan, elevation, and a capital, of the temple at Tefah or Tafa. Its pyramidal portico faces the south, and has two columns engaged in a wall almost to the bottom of their capitals, which represent the full-blown lotus, and support an entablature and cornice. Between the columns and the sides are small doorways with cornice and frieze; and above these, a second and third cornice, in each of which is the winged globe. The frieze has a bead and leaf worked on it. The front is about 27 feet long. The inside is perfect, having a roof supported by four clumsy columns standing on a plain circular base; their capitals, the full-blown lotus. The depth of the building is not more than twenty feet. Other magnificent ruins are found at Kalabshe; Gyrshe, Dakke, Dehr, Ebsambul, &c.

Nucleus, (Lat.) the middle part of the flooring of the ancients, consisting of cement, which they put between a lay or bed of pebbles, cemented with mortar made of lime and sand.

Nuel, see *Newel*.

Nymphæum, (Gr.) a name given by the ancients to picturesque grottoes in rocky and woody places, supposed to be dedicated to, and frequented by, the nymphs. The Romans often constructed Nymphæa in their gardens. One of the most celebrated amongst these ancient grottoes, was the Corycian cave on mount Parnassus, which was very extensive, and enclosed a spring of unusual size and clearness. In Attica may still be seen the remains of a nyphæum, adorned with many inscriptions and bassi relievi, from the rude workmanship of which, it may be presumed that the grotto is exceedingly ancient.

O.

Oak, (*ac*, *aec*, Sax.) from its strength, hardness, and durability, may be considered as the most useful of all timbers. It is found in almost every climate of the globe. The oak sometimes grows to an extraordinary magnitude. In vol. xviii. of the Gentleman's Magazine, are given the dimensions of a leaf, which was 12 inches long and 7 inches broad, and all the other leaves of the same tree were of equal size. An oak was felled on the estate of Woodball, which was 24 feet round, and sold for £43. Several very remarkable oaks are described in Hunter's edition of Evelyn's Sylva. In the Gentleman's Magazine for 1773, we have an account of a species of oak essentially differing from the common one, which grows about St. Thomas, in Devonshire, and is there called *Lucomb oak*: it grows as straight and handsome as a fir; its leaves are evergreen, and its wood as hard as that of the common oak; its growth is so quick as to exceed in twenty or thirty years the altitude and girth of the common one in a hundred. It is cultivated in Cornwall, Somersetshire, &c. M. de Buffon tried experiments with barked and unbarked trees, and proved that timber barked and dried standing, is always heavier, and considerably stronger, than timber kept in its bark. The best time for felling oak is in winter, when it is most free from sap, but it is considered most profitable to the owner to cut it down in spring, as the sap loosens the bark, which is sold to the tanner. The best way to season oak is to immerse it in water; when in logs, it should be done for twelve months, first soaking it, then drying it in a shade, and then soaking it again; but for planks, a much shorter time is sufficient. The oak was anciently a symbol of Jupiter, and the Druids selected the fairest and tallest tree of the wood, cut off all its side branches, and then joined two of them to the highest part of the trunk, like the arms of a man or cross; and they inscribed above and below the insertion of these branches the word *Thau* (God). Under this tree they performed their most sacred rites. —(*Borlase.*)

Obelisk, (Lat.) lofty pillars of stone, of a rectangular form, diminishing towards the top, and generally ornamented with inscriptions and hieroglyphics; amongst the ancient Egyptians, generally placed in the space before a temple. The period of their first origin is unknown, but we often read in ancient historians of their being erected by the Egyptian kings, and the Arabs still term them *Pharaoh's needles.* The Romans moved many of them into Italy, and erected them in the public places of Rome, and several are still preserved at Constantinople. See *Constantinople.* Several have also been found in England. The famous obelisks, denominated the *Devil's Arrows,* stand in the fields about half a mile to the south-west of the town of Boroughbridge, 200 feet asunder, and situated on high ground. Stukely and Plot affirm them to be British monuments, but Mr. Drake urges many arguments to prove them Roman. Dr. Gale supposed them to have been *Hermes,* which had lost their heads and inscriptions; but in a MS. note to his Antoninus, he confesses himself to be mistaken, there being no cavity whatever to receive a bust. Two square obelisks, of a single stone each, are found in the churchyard of Penrith: they are about 12 feet high, one about 12 inches in diameter, and 12 by 8 at the sides; the highest about 18 inches diameter, with something like a transverse piece to each, and mortised into a round base. They are 14 feet asunder, and between them is a grave enclosed by four semicircular stones of unequal lengths. This is called the Giant's grave, and ascribed to Sir Ewan Cæsarius, who is said to have been as tall as one of the columns, and able to stretch his arms from one to the other.—Holinshed, speaking of the ancient Scots, says, "the graves and sepulchres of our noblemen had commonlie so many obelisks and spires pitched about them, as the deceased had killed enemies beforetime in the field;" and adds, "they used not to write with common letters as other nations did, but rather with ciphers, and figures of creatures, made in manner of letters, as their epitaphes upon their toomes and sepulchres remaining amongst us doe hitherto declare." That the Runic obelisks of the northern nations were sepulchral we have decided proofs in Olan's Wormius, (Monum. Danic. p. 91—96.) The monstrous figures on them were hieroglyphics, by which, he says, they characterized the qualities of the deceased. The term *Runes* is applied to magical inscriptions upon leaves, &c. Of the inscriptions, it is remarkable that the most ancient are the best engraved: they are commonly written from top to bottom, and are said to have been introduced by Woden. Works on Obelisks have been published by Mercati, Bargarai, Fontana, Pouchard, (Acad. des Inscript.) Bandinii, Zoega, Kircher, &c. The works of most of the travellers in Egypt may be consulted. See *Abyssinian Buildings.*

Oblique Angle, one quarter, or less than a right angle.

Oblique Arches, such as cross a river, canal, &c. in an oblique direction.

Oblong, (Lat.) a rectangle of unequal dimensions.

Observatory, (Lat.) a building erected on an elevated spot of ground, for making astronomical observations. The Observatory of Greenwich was erected in 1676, by order of Charles II., at the solicitation of Sir Jonas Moore and Sir Christopher Wren. The Observatory of Paris is one of the finest in Europe, and was constructed between 1667 and 1672, from the drawings of M. Claude Perrault. The Observatory at Oxford was built after the designs of James Wyatt, at an expense of nearly £30,000; that at Cambridge has been lately erected at an expense of £60,000. Father Le Compte describes a very magnificent observatory, erected and furnished by the emperor of China, at Pekin, at the instigation of the Jesuit missionaries. Tycho Brahe's Observatory, called Uraniburg, in the little island Huen, between the coasts of Schonen and Zealand, was built, and furnished with instruments, at his own expense.

Obstructions to currents of water, are produced by square-ended piers, abrupt projections, &c. The Tables in the next page exhibit the rise of water they produce: we have carefully calculated them; and have placed them both on the same page, that they may be inspected at one view.—*See next page.*

Obtuse Angle, one greater than a right angle.

Obtuse Section *of a Cone*, a name given by the old geometers to the hyperbola.

Octagon, (*οκτω*, *eight*, *γωνια*, *an angle*, Gr.) a figure of eight sides and angles.

Octahedron, (Gr.) one of the regular solids, consisting of eight equal and equilateral triangles, which may be conceived to consist of two quadrilateral pyramids joined at the base, and consequently its solidity may be found by multiplying the quadrangular base (or the square of one of the sides) by one-third of the perpendicular height of one of the pyramids, and doubling the product.

Octostyle, (Gr.) a temple with eight columns on its principal façade.

Odeum, or **Odeon**, (Greek,) a species of theatre among the Greeks, in which the poets and musicians submitted their works to the approval of the public. It resembled other theatres in form, but was of less extent. The Odeon at Athens, was probably the first building of this kind erected in Greece. The Odeon of Pericles, was to the south-east of the Acropolis, between the extremity of the street of tripods, and the theatre of Bacchus. The second Odeon was denominated *Pnix*, and served as a place of public meeting for the Athenian citizens. The third Athenian Odeon was that of Herodius Atticus, at the foot of the Acropolis, on the south-west side. Pococke, Le Roy, and Stuart, all describe magnificent remains in this direction, which they suppose to be those of the theatre of Bacchus, but they appear in reality to be those of the Odeon of Herodius, and the ruins to which Stuart applies that name, are more probably those of the theatre of Bacchus. Other cities of Greece and Asia Minor had also their Odeons. That of Corinth was built by Herodius Atticus; and the splendid Odeon of Patræ was erected with the treasures acquired in a war between the Ætolians and Gauls. In its later times, Rome had also its Odeons. And relics of an Odeon have been found at Catania in Sicily, and at Pompeii. See *Theatre.*

Velocity.		Description of Rivers.		OBSTRUCTIONS.—Table I.															
per hour.	per sec.	Stream	Bottom.	$\frac{1}{12}$		$\frac{1}{10}$		$\frac{1}{8}$		$\frac{1}{6}$		$\frac{1}{4}$		$\frac{1}{3}$		$\frac{1}{2}$		$\frac{3}{4}$	
				Velocity in feet, and Head of Water, caused by the Obstruction.															
miles	ft. in.			Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head
$\frac{1}{6}$	3	Dull . . .	Mud	,34	,0008	,35	,0009	,36	,001	,37	,0012	,42	,0017	,468	,0024	,87	,005	1,75	,023
$\frac{1}{3}$	6	Gentle . .	Clay	,68	,0034	,69	,0036	,73	,0041	,75	,0049	,83	,0069	,937	,0098	1,75	,02	2,5	,094
$\frac{2}{3}$	1 0	Ditto . . .	Sand	1,36	,0134	1,39	,0145	1,46	,0162	1,5	,0197	1,66	,0276	1,875	,0393	2,5	,082	5,	,375
$1\frac{4}{11}$	2 0	Uniform tenors	Gravel	2,73	,0536	2,68	,058	2,93	,065	3,	,0788	3,33	,1104	3,75	,1572	5,	,328	10,	1,5
$2\frac{1}{22}$	3 0	Freshes . .	Pebbles, &c. . . .	4,09	,1207	4,06	,1305	4,39	,1462	4,5	,1773	5,	,2484	5,62	,3537	7,5	,738	—	3,375
$2\frac{8}{11}$	4 0	Ditto . . .	Ditto	5,45	,2146	5,45	,232	5,86	,26	6,	,3152	6,66	,4416	7,5	,6288	10,	1,312	—	6,
$3\frac{9}{22}$	5 0	Rapids & floods	Bolders & soft schistus	6,82	,3353	6,94	,3625	7,32	,4062	7,5	,4925	8,33	,69	9,37	,9825	—	2,05	—	9,375
$4\frac{1}{11}$	6 0	Ditto . . .	Stratified rocks . .	8,18	,4828	8,33	,532	8,78	,584	9,	,7092	10,	,9936	11,24	1,4148	—	2,954	—	13,5
$6\frac{9}{11}$	10 0	Torrents . .	Indurated rocks . .	13,64	1,341	13,9	1,45	14,6	1,625	15,	1,97	16,3	2,76	—	3,93	—	8,2	—	37,5

The following Table is applicable to such Obstructions as Piers with pointed Sterlings, &c. which are formed to diminish the contraction and force of the water. It is intended also to show the effects of Accidents, &c. to which Rivers are liable: and it appears from it, that when the Velocity equals ten feet, the inundation will carry away every thing before it.

Velocity.		Description of Rivers.		OBSTRUCTIONS.—Table II.															
per hour.	per sec.	Stream.	Bottom.	$\frac{1}{12}$		$\frac{1}{10}$		$\frac{1}{8}$		$\frac{1}{6}$		$\frac{1}{4}$		$\frac{1}{3}$		$\frac{1}{2}$		$\frac{3}{4}$	
				Velocity in feet, and Head of Water, caused by the Obstruction.															
miles	ft. in.			Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head	Vel.	Head
$\frac{1}{6}$	3	Dull . . .	Mud	,28	,0003	,29	,0004	,3	,0004	,32	,0006	,35	,001	,394	,0014	,52	,0033	1,05	,0162
$\frac{1}{3}$	6	Gentle . .	Clay	,56	,0011	,58	,0014	,6	,0017	,63	,0023	,7	,004	,787	,0058	1,05	,0133	2,1	,0647
$\frac{2}{3}$	1 0	Ditto . . .	Sand	1,13	,0045	1,16	,0056	1,2	,0069	1,26	,0091	1,4	,015	1,575	,0231	2,1	,0532	4,2	,259
$2\frac{1}{3}$	2 0	Uniform tenors	Gravel	2,27	,0182	2,33	,0225	2,4	,0276	2,52	,0364	2,8	,06	2,75	,0924	4,2	,2128	8,4	1,036
$2\frac{1}{22}$	3 0	Freshes . .	Pebbles, &c. . . .	3,4	,0409	3,39	,0507	3,6	,0621	3,78	,0819	4,2	,135	4,325	,2079	6,3	,4788	12,6	2,331
$2\frac{8}{11}$	4 0	Ditto . . .	Ditto	4,54	,0728	4,66	,0902	4,8	,1104	5,04	,1456	5,6	,24	5,5	,3696	8,4	,8412	16,8	4,144
$3\frac{9}{22}$	5 0	Rapids & floods	Bolders & soft schistus	5,68	,1137	5,83	,141	6,	,1725	6,3	,2275	7,	,375	7,875	,5775	10,5	1,32	21,	6,475
$4\frac{1}{11}$	6 0	Ditto . . .	Stratified rocks . .	6,81	,1638	6,99	,203	7,2	,2484	7,56	,3276	8,4	,54	9,45	,8316	12,6	1,9152	25,2	9,324
$6\frac{9}{11}$	10 0	Torrents . .	Indurated rocks . .	11,80	,455	11,66	,564	12,	,69	12,6	,91	14,	1,5	15,75	2,31	21,	5,32	42,	25,9

Oecus, the banqueting-room of a Roman house. See *House.*

Office, (Lat.) in general, an apartment for the discharge of any particular duty or employment.

Offsets. When the face of a wall is not one entire or continued surface, or when it is formed by two or more continued surfaces, each rising from the horizontal base which forms the top part of the wall below; the part thus connecting the two surfaces is called an *off-set.*

Ogee, a moulding the same as the cyma reversa. See *Moulding.*

Ogive, an arch or branch of a Gothic vault, which, instead of being circular, passes diagonally from one angle to another, forming a cross with the other arches. The centre where the ogives cross is called the *key*, and is cut in the form of a rose, &c. The members or mouldings of the ogives are called *nerves*, *branches*, or *reins*, and the arches which separate them, *double arches.*

Olympia, a city of Greece, celebrated for being the scene of the Olympic games, and for its once splendid temples. The temple of Jupiter Olympius has been explored by Gell, and his measurements published in the Appendix to Wilkins' Magna Græcia. The proportions observed in the several parts of the front of the temple appear to have been nearly the same as those of the temple of Theseus at Athens. The diameter of the angular columns at the base of the shaft were found to be 7′ 1″. There is, however, some little difference in the proportion of the intervals between the columns, which is accounted for by considering that this temple required a greater extent, to admit staircases in the transverse walls of the cella. Had the length of the cella been 88 feet, double the width, the extent of the cella and staircase walls together, according to the proportions of the temples at Agrigentum, would have been 99′, which deducted from Gell's dimension of 127′, leaves 28 feet for the extent of the pronaos. The distance between the axes of the angular columns was 44 feet. This temple may be added, Mr. Wilkins observes, to the list of those in which the number of columns in the flanks exceeded the double of those in the fronts by one. See *Temple.*

Olympius, Jupiter, *Temple of*, see *Athenian Architecture.* In the plan of this temple given in our plates to that article, A marks the south-east angle of the peribolus, B the south-west angle, C the remains of the west end, D the arch of Hadrian, E a column whose base being similar to those in the external row in the south-east angle, proves it to have been one of the external range, and consequently that the temple had twenty columns in flank.

Onerariæ, see *Naval Architecture.*

Opæ, (οπη, Gr.) the cubilia, or beds, of the beams of a roof, on which rest the metopæ.

Openings, (Sax.) those parts of the walls of a building, which are left unfilled up, for admitting light, air, &c.

Opera House, a theatre for performing musical dramas. Amongst the most celebrated buildings of this description, is that entitled *La Scala*, at Milan, and that of *San Carlos*, at Naples. The next to these are the Italian Opera-house, at Vienna, and the King's Theatre, in London.

Opisthodomus, the same as the Roman *posticum*, a term applied to the hinder part of a temple, when there is a regular entrance, and a façade of columns as in front. It was a custom with the ancients to preserve their treasures, public records, &c. in this part of the temple, which was often extensive, and situated immediately behind the cella. Doubts have lately existed, whether the treasury of the state in the Parthenon, was not a distinct building separate from the opisthodomus or treasury of the temple. See Wilkins' *Atheniensia*, p. 99.

Opposite Cones, two similar cones, which have the same common vertex, and the same axis.

Opposite Sections, hyperbolas made by cutting opposite cones by the same plane.

Orangery, (Fr.) a kind of hothouse for orange trees.

Oratory, (Fr.) a closet for private devotion, near a bed-chamber, in Roman Catholic families, with altar, crucifix, &c.

Orb, (*orbis*, Lat. *a sphere*,) a knot of flowers or herbs, placed at the intersection of several ribs in a Gothic ceiling, to conceal the mitres of the adjoining ribs.

Orchestra, (Gr. from *ορχεομαι*, *to dance*,) the place in the ancient theatres where the chorus used to dance: in modern theatres the name is given to the place where the musicians sit.

Orchomenos, an ancient city of Bœotia, in Greece. Traces of the former strength and magnificence of this city still exist. At the east foot of the acropolis are the small remains of the treasury of Minyas, which Pausanias describes as one of the wonders of Greece. The entrance is entire, though a great part of it lies buried in the accumulated earth, only six large blocks of regular masonry remaining above the ground. The whole of the building was of white marble: the lintel or architrave is flat, and composed of a single block, 15 feet 4 inches long, 6 feet 3 inches broad, and 3 feet 3 inches thick. It bore a great resemblance to the treasury at Mycenæ. Similar edifices, called *noragis*, though smaller, still exist in Sardinia. Part of the acropolis is built in the Tirynthian style. Dodwell has engraved a very curious sun-dial found there. See Gell's Itin. of Greece.

Order, (Lat.) The five orders of Architecture, as transmitted to us from antiquity, are, the *Doric*, the *Ionic*, the *Corinthian*, the *Tuscan*, and the *Composite ;* of the peculiarities and origins of which an account will be found under those heads.

The application of the Doric is particularly commendable in large and majestic edifices. The Earl of Aberdeen truly observes, that "the remains of a dipteral temple, with columns composed of the purest marble, more than six feet and a half in diameter, and sixty feet in height, cannot be described in any terms commensurate with the sensations excited by the view of the original."

Mr. Wilkins, in his Introduction to the Antiquities of Magna Græcia, supposes the temple of Solomon to have been the prototype of the early Grecian temples, particularly those of Magna Græcia. In this investigation he has thrown much light on its architecture and proportions. He supposes its columns to have been Doric, and gives the following scale of the heights of Doric columns, supposing their diameter to be unity.

Temple of Solomon	4.713 4.582
Jupiter Panhellenius	5.397
Jupiter Nemæus	6 515
At Corinth	4.065
Ægesta	4.434
Pæstum	4.362

Of Minerva at Syracuse	4.410
Juno at Agrigentum	4.695
Minerva at Athens	5.566
Minerva at Sunium	5.809
Theseus at Athens	5.669

Aikin, in his "Essay on the Doric Order," has given the following Table of Proportions:—

	Bot. Diam.	Top Diam	Height of Column.		Archi trave.	Frieze	Cornice.	Intercolumniation.	
	min.	min.	dia.	min.	min.	min.	min.	dia.	min.
Portico of the Agora, Athens	60	47	6	2½	40	42	21	—	
Temple of Minerva, Sunium	60	45¾	5	54	48½	48½	—	1	28
Jupiter Nemæus	60	49	6	31	38¾	43⅓	—	—	
Jupiter Panhellenius	60	44½	5	24	31⅓	51½	—	1	41
Theseus	60	46⅔	5	42⅓	50	49½	—	1	37½
Minerva, Athens	60	47	5	33½	43	43	32	1	17⅔
at Corinth	60	44⅔	4	4	48⅓	—	—	1	14
Portico of Philip	60	49½	6	32½	38½	43¾	25½	2	4[illegible]
Temple of Apollo	60	42⅓	6	3¾	49⅔	42½	—	—	
Minerva, Syracuse	60	46	4	24½	44½	40	—	1	5⅔
Juno Lucina	60	45⅓	4	42	55	45	—	1	15
Concord	60	46	4	45¼	46⅔	46⅓	25	1	10⅔
Pseudodipteral Temple, Pæstum	60	40⅓	4	27	50	—	—	0	59⅓
Hexastyle Temple, Pæstum	60	43	4	47¾	45⅝	44¾	24⅝	1	1½
Hypæthral Temple, Pæstum	60	41¼	4	8	42⅓	40½	21½	1	4⅔
Inner Peristyle of ditto	60	43	4	13⅓	39	—	—	1	22⅔
upper Columns	60	44⅓	3	50	68	—	—	2	49
Temple of Selinus	60	46	4	21¾	46⅓	44⅔	—	—	
Jupiter, Selinus	60	35½	4	34⅓	52	44⅔	26	—	
Ægesta	60	44¾	—		49⅔	52⅔	40⅝	1	11
Theatre of Marcellus	60	48	7	51⅔	30	45⅝	37⅝	—	

In a Doric architrave, of which a figure is given by Stuart, are observed four guttæ, without the tænia. A similar departure from architectural propriety has been discovered in one of the temples at Selinus, where, under the mutules between the triglyphs, three guttæ are observed, corresponding with the narrow width of the mutules over the metopes.

The few specimens of the Ionic order, now remaining at Rome, are of so little merit, that Palladio, Vignola, and other modern authors, have been chiefly resorted to as standards in this order, as well as the Doric, till the discovery of the antiquities of Greece by Messrs. Stuart and Revett, brought into notice the admirable specimens of Ionic architecture, which have ever since met with so much attention from the best informed architects, as well as connoisseurs. The Choragic monument of Lysicrates has been supposed, by some, to be the most ancient known example of the Corinthian order. But the capitals of the columns attached to the interior of the cella of the temple of Apollo Didymeus, near Miletus, may claim a greater antiquity, for it was rebuilt by Peonius, after its destruction by Xerxes, 479 B. C.; perhaps even previous to the time of Callimachus. The capitals of this temple bear a considerable resemblance to those of the monument of Lysicrates, in their single row of leaves, their central honeysuckles, and in the channel at the springing of the leaves. The flower expanding itself between the leaves, reminds us of the Egyptian lotus, and, with other considerations, tends to induce us to adopt the supposed Egyptian origin of this order, and reject the claim of Callimachus to its invention, although he may have given it a new form. Three singular Corinthian capitals are engraved by Wilkins, in the Appendix to his Antiquities of Magna Græcia: they were found in the Archipelago, and in Sicily. The Corinthian order may be seen in great perfection, in what remains to us of the antiquities both of Greece and Rome. Another Athenian edifice, of the Corinthian order, is the arch of Hadrian. The antæ at this building have a very sensible diminution, while in structures of the age of Pericles they were never perceptibly diminished. The introduction of the Ionic echini, also, beneath the foliage of the capitals of the antæ, savours of the declension of pure Grecian art.

Of the Tuscan order there is no ancient specimen, unless a small tomb near the Trajan column at Rome, is to be so considered.

The Composite order is peculiar to Italy. The Composite order does not appear to have been considered by the Romans as a distinct one; but the name has been given to it by the Italians, and it is considered as combining the entablature and dentils of the Ionic, with the mutules of the Doric, and enrichments of the Corinthian. It is heavy without grandeur, and rich without beauty; and it is to be regretted that Sir Christopher Wren has made so much use of it about St. Paul's. The base commonly given to it consists of two tori, the lowest considerably the largest, with two scotiæ enclosing an astragal. The attic base is, however, more commonly used. The proportions of this order are given in the plate *Composite* or *Roman Order*, which is a capital from the arch of Vespasian and Titus.

Ordinates, (*ordinatim applicatæ*, in Lat.) in Conics, parallel lines terminating in a curve, and bisected by a diameter. The *Ordinate of an Ellipse*, is a straight line drawn perpendicularly to the axis major, from any point in it, to meet the curve.

Ordonance, the giving to all parts of a building the just dimensions, &c. which they ought to have according to the model.

Organical *Description of Curves*, the description of them upon a plane by means of instruments.

Oriæ, (Lat.) wherries, see *Naval Architecture*.

Oriel Window, a projecting angular window, commonly of a triagonal or pentagonal form, and divided by mullions and transoms into different bays and compartments.

Original *Point*, *Line*, or *Plane*, in perspective, a point, line, or plane, referred to the object itself. See *Perspective*.

Orillon, in fortification, a small rounding of earth lined with a wall, which is raised on the shoulder of those bastions that have casements to cover the cannon in the retired flank, and to prevent their being dismounted by the enemy.

Orle, (*orlo*, Ital. *to hem*,) a fillet or band under the ovolo of the capital. Palladio applies the term also to the plinth of the base of a column or pedestal.

Ornaments, (Lat.) the smaller and more detailed parts of a work of art, which are not essential, but only serve to enrich it. The ornaments of the architecture of the most ancient people are confined to the representations of nature, flowers, leaves, and branches; afterwards the figures of men and animals were introduced. Amongst the Greeks ornament was at first confined to the interior of the edifices, and it was not till a later period that they began to ornament the exterior likewise. An architect ought to possess some general knowledge of painting and sculpture, in order to be able to direct the application of ornaments with advantage; and it has been observed with great justice, that, in order to preserve harmony and consistency throughout, one eye should superintend the whole of the workmen employed.

ORTHOGONAL, (Gr.) rectangular.

ORTHOGRAPHICAL PROJECTION *of the Sphere*, the drawing the superficies of the sphere on a plane which cuts it in the middle, the eye being placed at an indefinite distance vertically to one of the hemispheres.

ORTHOGRAPHY, (Gr.) the elevation of a building at any of its particular parts. In geometry, it is applied to the art of delineating the foreright plan of any object, and of expressing the heights or elevations of each part. In perspective, *orthography* is the foreright side of any plane, that is, the side or plane that lies parallel to a straight line, which may be imagined to pass through the outward convex points of the eyes, continued to a convenient length. In fortification, it is the profile or representation of a fortress made after such a manner, that the length, breadth, and height of its several parts may be represented.

OSCULATING CIRCLE, the circle of Curvature.

OVA, (Lat.) an ornament in form of an egg.

OVAL, a geometrical figure, bounded by a curve line returning to itself, including the ellipsis, or *mathematical* oval, and all figures resembling it, though with different properties.

OVICULUM, the diminutive of *Ova;* a little egg.

OVOLO, (Ital.) see *Echinus*.

OUTLINE, an exterior or bounding line.

OUT OF WINDING, perfectly smooth and even, or forming a true plane.

OUT TO OUT, to the extremities or utmost bounds.

OUTFALL, a canal or drain to carry off waters.

OUT-WORKS, in fortification, all works raised without the enclosure of a place, to cover it from the enemy.

OXYGON, (Gr.) an acute-angled triangle, from οξυς, *acute* or *sharp*, and γωνια, *an angle*.

P.

PACE, a measure of five feet.

PADDLE, (*pattal*, Welsh,) a small sluice: *Paddle-holes* are the passages which conduct the water from the upper pond of a canal into the lock, and out of the lock into the lower pond. They are called also *clough arches*.

PÆSTUM, or *Posidonia*, a town of Italy, sixty miles from Naples. Of the origin of Pæstum, ancient authors have left us no account, and its history is very obscure. The Saracens crossed over from Sicily about A.D. 840, and took possession of this tract of territory, and when they were obliged to abandon it, they plundered the city and destroyed the dwellings. And in 1080 Robert Guiscard stripped its temples to decorate the church he had founded at Salernum. It has since gone entirely to decay, and the present town, called *la Citta di Pesto*, consists of a few scattered cottages within the ancient walls. The principal ruins of the ancient city consist of the walls, the remains of three temples, vestiges of the amphitheatre, and two spots distinguished by heaps of stones, the site of some important buildings. The only Grecian building is the great temple, supposed to have been dedicated to Neptune, and distinguished by its solidity, simplicity, and grace. It is characterized by low columns, with a great diminution of the shaft, bold projecting capitals, a massive entablature, and triglyphs placed at the angles of the Zophorus. The shafts of the columns, although at first sight they appear to swell in the middle, are diminished in a straight line. The temple is hypæthral, has six columns in the fronts, and fourteen in the flanks, including those at the angles. The upper step of the stylobate is a parallelogram, 195′ 4″ long, and 78′ 10″ broad. The columns have twenty-four flutings, but the number on the columns of the lower range within the cella is only twenty, the regular number in the Doric order: in those of the upper range they have only sixteen. The plan of the flutes at the base is the segment of a circle, below the capital that of an ellipse. The drops are conical, and the mutules appear to have been of the same form, but none remain. The cella was separated into three divisions by a double range of columns, two tiers in height; the cella was approached both by the posticum and the pronaos, and in the transverse wall of the latter were inserted the staircases leading to the roof and the apartments over the vestibule. The columns are in diameter 6′ 10″ 36; in height 28′ 11″ 5, including the capitals; height of entablature 12′ 2″ 2; height of columns of interior range, 19′ 9″; diameter 4′ 8″ 1. The diameter of the columns in the upper range was determined by the diminution of those in the lower, since each upper and lower column may be considered as a frustum of the same cone, continued through the epistylia. All the lower columns still remain, and seven of the upper. The lateral walls have fallen, except those parts contiguous to the antæ of the vestibules.

The second temple was pseudodipteral, and has nine columns in the fronts, thus differing from every other in existence. The pronaos has three columns between the antæ, three columns of a range which divided the cella are still remaining. The similarity of its columns to those of the third and lesser temple, proves them to be nearly coeval. Its length measured upon the upper step is 176′ 9″, its breadth 80′. It has 18 columns in each flank; diameter of the columns at the base of the shafts 4′ 9″ 75; height including capitals 21′. The shafts diminish in a curve, and have twenty flutings, which terminate in a semicircle at the top. The lower part of the *ovolo* of the capital is ornamented with sculpture, which is not alike in all the capitals; in some it is omitted. The antæ of the pronaos, contrary to the practice of the Greeks, diminish like the columns, and are crowned with a singularly formed capital. The lesser temple is hexastyle-peripteral, having six columns in the fronts, and thirteen in the flanks, reckoning those at the angles. The temple within the peristyle appears to have consisted of an open vestibule, a cella, and an opisthodomus, or sanctuary. Instead of a continuation of the walls of the cella, the pronaos was a portico, open in front and sides, and terminated by the transverse wall of the cella. The columns appear to have been channelled into twenty-four shallow flutings, but all that remain are four bases, with a small portion of their shafts. Length of temple on upper step 107′ 9″ 93; breadth 47′ 7″ 9; diameter of columns at base 4′ 2″ 9; height of columns, including capital, 20′ 4″ 25. The columns are diminished in a straight line, and terminate at the astragal below the necking; they have twenty flutings, of a circular plan both at top and bottom. The upper part of the epistylium is formed by a course of stone 11.5 inches deep. The epistylia at the angles are joined diagonally. The cornice does not resemble the Grecian Doric; instead of mutules, it has panels sunk in the soffits of the principal member. There are, beside these temples, several other traces of edifices, but in such a ruined state, as to leave it totally uncertain of what kind. In plate *Ægesa*, fig. V. is a section through the cella, and outer porticoes of the hypæthral temple. Besides Mr. Wilkins' work, the reader may consult *Dumont*, Vues et Détails de Pæstum—*Morghen*, Sei vedute delle Ruine di Pesto—*Miller*, The Ruins of Pæstum or Posidonia—Major's Ruins of Pæstum—*Piranesi*, Vues de quelques Restes, &c. de l'ancienne ville de Pesto—*Paoli*, Pæst. quod Posidoniam estiam dixere, rudera—*Delagardette*, Les Ruines de Pæstum—*Franzetti's* Chalcography—*Antonini*, Dissertations sur la Lucanie,—*Riedesel*, Voyage en Sicilie, &c.—*D'Orville*, Sicula—*Pancrazi*, Le antichitá Siciliane spiegate—*Winckelmann*, Remarques sur l'Architecture—*Lalande*, Voyage en Italie—*Forsyth's* Italy.

Pagetting, a name given to rough plastering, especially to that in the interior of chimney flues.

Pagoda, (a corruption of *poutghad*, Pers. *a house of idols*,) the name given to the temples of India, China, &c. See *Hindú* and *Chinese*.

Pagodas, Seven, a remarkable monument of Hindû antiquities at Mavalipuram, close to the sea, a few miles north of Sadras. They are described by Mr. Chambers in a paper in the Asiatic Researches: when visited in 1776, there was still a village adjoining to them, which retained the ancient name, and was inhabited by a number of Bramins, who seemed well acquainted with the subjects of the sculptures to be seen there. The rock, or rather hill of stone, on which great part of these works are executed, rises abruptly out of a level plain of great extent, and at a distance has the appearance of an antique and lofty edifice. Proceeding by the foot of the hill, on the side facing the sea, there is a pagoda rising out of the ground, of one solid stone, about eighteen feet high, which seems to have been cut on the spot out of a detached rock, that had been found of a proper size for that purpose. The top is arched, and its style of architecture differs much from any now used in those parts. Beyond this is a numerous group of colossal figures in basso relievo, much defaced. The ascent of the hill is rendered easy by artificial steps. A winding stair leads to a kind of temple cut out of the solid rock, with figures of idols in high relief on its walls, well finished, and in good preservation. This temple, Mr. Chambers considers to have been a place of worship appertaining to a palace, of which some remains still exist, and to which there is a passage by another flight of steps. This conjecture is also favoured by the traditions of the Bramins. On the opposite side of the hill, a flight of steps leads to another excavation near the summit, which contains various sculptures of Hindû deities, the most remarkable of which is a gigantic figure of Vishnou, asleep on a kind of bed, with a huge snake wound about in many coils by way of pillow. About a mile and a half to the south of the hill, are two pagodas, of about thirty feet long by twenty wide, and about as many in height, cut out of the solid rock, and each consisting of a single stone. Near them stand an elephant full as large as life, and a lion considerably exceeding the natural size, well executed out of a single stone each. The architecture of these works resembles our Gothic, being surmounted by arched roofs or domes, which are composed of two segments of a circle meeting in a point at the top. The lion in this group, as well as one on a stone couch, in what he took to be the royal palace, are very exact representations, and the natives here give them the name of *sing*, which is always understood to mean a lion in the Hindû language, but the figures which they have made to represent that animal in their idol temples for centuries past, though it bears the same appellation, is a distorted monster, so much unlike the original, that it has been hence supposed that the lion was not anciently known in this country, and that *sing* was a name given to a monster that existed only in Hindû romance. In the neighbourhood there are found various other remains of buildings and sculptures, and our author conjectures from these and other circumstances, that the magnificent city, of which these appear to have been part of the ruins, has been destroyed, partly by an earthquake, and partly by a sudden inundation of the sea, occasioned by this commotion of the earth.

PAINTING, see *Fresco*, *Stucco*, &c. Painting in fresco is very common in the remains of Egyptian buildings. It is also traced in the architectural remains of India. In the middle ages, the place of painting on the walls was supplied by embroidery and tapestry. This practice appears to have been brought from the East, and originated, perhaps, from the costly hangings of the palaces of the kings of Persia and Phœnicia. Much information concerning the paintings which enriched the walls of royal and noble castellated structures in the middle ages, is contained in Walpole's Anecdotes of Painting, and in the second volume of Warton's History of Poetry. From the "Dream," of Chaucer, it would appear that such circumstances of embellishment were not confined to the castles of the sovereign and the nobility, but were adopted also in the chambers of dwellings belonging to private gentlemen. The poet, when roused from his dream, found all the gay images of fancy vanished, and saw nothing:—

> "Save on the wals old portraiture
> Of horsemen, haukis, and houndis,
> And hurt dere, all full of woundis."

Ceilings, stair-cases, and works which require no great care and preparation. are generally painted in common water colours, that is, with earths infused in water, and diluted in size. All kinds of colours may be ground in water only, when the tint is made: and when they have been infused in water, they must be mixed up with size. If on new plaster, the colours require more size. Spanish white, pounded in water, mixed with a proper quantity of the black of charcoal, according to the tint you want, makes a good common white. The white *des carmes* is a manner of whitening interior walls, which renders them extremely beautiful. A quantity of the very best lime must be passed through fine linen, and poured into a large tub, with a spigot just as high as the lime occupies; fill the tub with clear spring water, beat it with a piece of wood, then allow it to settle for twenty-four hours, and let the water off, supplying the tub with fresh water, and continuing the operation for several days, till the lime attains the greatest degree of whiteness; then turning off the the water, the lime will be found of the consistence of paste, and should when used be mixed with size made of fine glove-leather and a little alum with a little Prussian blue or indigo, and a small quantity of indigo. Since the discovery of oil painting, and the knowledge that wood is preserved by it, and especially since the discovery of a varnish without smell, and which even takes away that of oil, the painting of apartments with oil has been justly preferred.

In the 26th volume of the Repertory of Arts, a specification of a patent is given, which was granted to Mr. Joseph Braham, for the application of Parker's Roman cement, of the consistence of whitewash, to timber, to preserve it from the dry-rot; and for using the same composition or cement mixed with oil, to form a very good and cheap paint, for floor-cloths, or inside or outside house-painting. The mixture of Parker's cement with oil, forms a very cheap and efficacious paint for out-door work. The following receipt is not generally known—

Potatoes	1 lb.
Spanish White	2 lbs.
Water	4 quarts.

The potatoes, boiled first, and well tempered, and strained through a sieve; the Spanish white, previously mixed up, is then added. The colour is a fine milk white rendered grey by charcoal; dries soon and well: use two coats. A kind of paint or stucco formed of tar and chalk, was put over the planks placed under the carriage way of the Iron Bridge, at Sunderland.

PALACE, (*palatium*, Lat.) the dwelling house of a king, prince, or bishop. In China it is customary to build palaces in honour of celebrated ancestors, and in the year 1263, Hu-pi-lay, of the Mogul empire, built one for his ancestors, after the example of those of China. There is an account in the Ancient Universal History, of a magnificent palace in Upper Egypt, not far from Assuan, (the ancient Syene) the ruins of which, by their vast extent and magnificence, impress the mind of the spectator with amazement.—Egyptian palaces consisted of moles or causeways, courts surrounded by a colonnade, porticos, and other assimilations of temples. The palace of Thebes, at Medinet Abou, is the only remain which was evidently not a temple, though it was contiguous to one. It has an upper story, windows, small doors, a staircase, very solid balconies, supported by a kind of caryatides and crenellations, of which no other specimen is known. Near the peristyle are five apartments, two of which appear to have been the treasury: the stone coffers yet remain. The interior view of this edifice is extremely superb. The plan of this palace is given at fig. 12, on plate *Temple*, in which *a a* represents the first pylône or propylon, forming the entrance: *c* the first court: *b* caryatic pillars, forming the gallery of the north side: the colonnade on the opposite side are regular round columns: *d* the entrance to an edifice now buried in the fallen ruins: *l l* second pylône: *e e* portals of granite: *f f* doors to the stairs which lead to the top of the second pylône: *g* the peristyle; the galleries of the peristyle are formed on the north and south by columns, on the east and west by caryatic pillars, behind the west range of which is another range of columns: the building does not exactly correspond with the cardinal points: *h* rooms concealed under the ruins, which were entered by a passage forced through the wall at *k*. The whole of the interior part of the building *i*, which would appear to have contained the principal apartments, was so completely choked up and buried in its ruins, as to render it quite impossible to explore it. The columns in the peristyle have Corinthian capitals, but are not fluted. (See the Grande Description de l'Egypt.) The details which Homer gives us of the palaces of the kings in the heroic ages are curious and authentic. Some remains of these very ancient buildings still remain. See *Acropolis* of *Tyrins*, & *Mycenæ*. The Romans applied the name of *domus*, for a long time both to the houses of the poor and the great; and even as late as the time of Nero, his sumptuous palace was termed *domus aurea Neronis*, Nero's golden house. The palace of Dioclesian, at Spalatro, though in ruins, is a remarkable relict of ancient art. Its shape was that of a parallelogram, 630 feet long, and 510 broad. Its principal façade fronted the sea, and was decorated with a superb colonnade, which was composed of fifty columns, forty-two still remaining: this colonnade formed a gallery 25 feet broad, reaching along the whole of the front. See the Voyage Pittoresque of *M. Cassas*, in Istria and Dalmatia. *M. Durand*, in his *Paralèle des Edifices de tout genre*, has given a collection of designs of palaces of different eras.

PALÆSTRA, (from παλαιω, Gr. *to wrestle*,) that part of the Grecian Gymnasium, more particularly appropriated to wrestling and other gymnastic exercises. The term was sometimes applied to the whole building. The palæstra contained also baths, which were thrown open for the use of the public. Vitruvius asserts positively, that there were never any *palæstræ* at Rome.

PALATINE BRIDGE, a bridge at Rome, which is now called *St. Mary's bridge*, and passes from the present church of St. Mary the Egyptian, at the lower end of the Forum Boarium to the Via Transtiberina.

PALE, (derived, according to Du Cange, from *palla*, Lat. a *hanging*, or *tapestry*,) a pointed stake, and piece of board, used in making enclosures. See *Post* and *Paling*.

PALENQUE, a town of Guatemala, in America, near which are found the ruins of an ancient city, which were explored by Antonio del Rio, and a translation of his Report published at London, in 4to. 1822. The site of the ruined city is called *Casas de Piedras*; the stone houses, and the remains, and particularly the figures, present a wide field for investigation. The largest building occupies a mound twenty yards high, in the middle of the plain, and is surrounded on every side by other buildings. The ruins extend about seven or eight leagues, but their breadth is much less. The interior of the large building is in a style of architecture strongly resembling the Gothic, and from its rude and massive construction promises great durability. The entrance is on the eastern side, by a portico or corridor thirty-six *varas* or yards in length, and three in breadth, supported by plain rectangular pillars, without bases or pedestals, with architrave formed of square smooth stones, a foot thick, and over them another plain rectangular block, five feet long, and six broad, extending over two pillars. In the walls is a range of windows like niches, some square, and others in form of a Greek cross.

Paling *for Trees*, a sort of fencing for separate trees, formed by three small posts, connected with cross bars.

Palisades, pales or stakes set up for an enclosure. *Palisades*, or strong sharp-pointed wooden stakes, sometimes armed with iron spikes, fixed in the ground, are used in fortification.

Palladio, Andrea, an Italian Architect of Vicenza, born in 1518. He received his first instructions from the poet Trissino, whom he accompanied to Rome, and there studied the ancient edifices of that celebrated city. His first great work was the palace Foscari, which he built in the pure antique style. He was afterwards invited to the court of Emanuel Philibert, duke of Savoy, where he met with a most flattering reception. The Olympic theatre at Vicenza, which he built in imitation of that of Marcellus at Rome, is considered to be his master-piece. He died at Vicenza, in 1580. His Treatise on Architecture, which was first published at Venice in 1570, has gone through many editions. He also composed a small work entitled *Le Antichità di Roma*, and he illustrated Badelli's Translations of Cæsar, by a preface on the military system of the Romans, with copper plates, chiefly designed by his two sons, Leonida and Orazio. Lord Burlington published a volume, with the title *Idisegni delle Terme Antiche di Andrea Palladio*, London, 1730.

Pallier, or *Paillier*, a French term, which signifies a landing-place in a staircase, which is broader than the rest o the stairs, and serves as a resting-place. Vitruvius calls the palliers, or landing places of theatres, *diazomata*.

Pallification, or *Piling*, the act of piling ground-work, or strengthening it with piles.

Palm, a measure of length among the Italians, often used in the works of Winckelmann, in the Antiquités d'Herculanum, by Visconti, &c. The palm of Genoa is nine inches nine lines—that of Naples, eight inches seven lines—that of Palermo, eight inches five lines—the modern Roman palm, eight inches three and a half lines.

Palmyra, or *Tadmor*, a city of ancient Syria, said to have been originally founded by Solomon, the ruins of which are found in the middle of the desert, between Damascus and the Euphrates. The verdant tract on which it is situated was perhaps formerly far more extensive than at present, and the city was probably enclosed among palms and fig-trees, from the former of which it appears to have taken its name. The ruins were discovered in an accidental manner, in 1678, by some English travellers from Aleppo. Dr. Halley, soon after this period, published Observations on the state of Palmyra. Seller also published a work on the antiquities of Palmyra at London, in 1696, and Halifax's Voyage to Tadmor appeared in 1705. But the most important work is that by Wood and Dawkins: *The Ruins of Palmyra, otherwise Tadmor in the Desart*, fol. London, 1753. The most magnificent ruin is the temple of the sun, the remains of which spread over a square of two hundred and twenty yards, and which was surrounded by a stately wall, built of large square stones, and ornamented with pilasters both within and without. In the court two rows of noble pillars appear to have supported a double piazza all round; fifty-eight of them still remain entire and are thirty-seven feet high, with capitals of the most exquisite workmanship. The walls of this piazza on that side opposite the temple were evidently the most elegant. At each end of this line are two niches for statues, most beautifully carved, with their borders, supporters, canopies, and pedestals. In the middle of the court stands the temple, which was encompassed by a row of columns fifty feet high, of which sixteen remain. The temple is thirty-three yards long, and thirteen or fourteen broad, and points to the north and south. In the middle of the west side is the entrance, on which are remains of the most beautiful sculptures. The windows were not large, and were narrower at the top than at the bottom. In the centre is a dome about ten feet in diameter, which appears either to have been hewn out of the rock, or made of some composition which time has rendered equally hard. The north end of the temple is ornamented with curious fretwork and bassi relievi. Several obelisks are found in the immediate neighbourhood of the temple: about a hundred paces from the middle obelisk is a grand entrance to a piazza, which is more than half a mile long, and forty feet broad, and the pillars which border it on each side are twenty-six feet high, and eight or nine in circumference. Their number is supposed to have been five or six hundred, and one hundred and twenty-nine yet remain. To the left of the piazza are the remains of a magnificent building, which appears to have been a banqueting house; it is built of fine marble, and most exquisitely finished, and its pillars are each of one single stone, so strong, that one of them, although it has fallen down, has received no injury; it is twenty-two feet long, and eight feet nine inches in compass. In the west side of the piazza are several apertures for gates into the court of the palace, each one adorned with four porphyry columns, placed by couples in front of the gate facing the palace; only two of these columns remain entire, which are thirty feet long and nine in circumference. On the east side of the piazza stand a number of marble pillars together, and at a small distance the remains of a lesser temple, with a piazza before it supported by six pillars. The pedestals of those in front have inscriptions in Greek and Palmyrene characters, but much defaced. At the north part of the city, ranged on each side of a hollow way, more than a mile in extent, are the ruins of the ancient sepulchres, which are square towers, four or five stories high, varying in magnitude and splendour. The outside is of common stone, but the floors and partitions of each story are of marble; a walk runs across the building in the middle, and the space on each side is divided into partitions for the reception of the corpses. There have been discovered at Palmyra twenty-six inscriptions in Greek, thirteen in Palmyrene, and one in Latin. The subject of the Palmyrene characters and language, has given rise to much dispute, and has been discussed by Scaliger, Petit. Galand, Spond, Norris, and the Abbé Barthelemy, but Georgius (de Inscriptionibus Palmyrenis) has shewn them with tolerable satisfaction to be Syro-chaldaic. Some fine views of the ruins of Palmyra are given by *M. Cassas*, in his Voyage pittoresque en Syrie. On the language, see the explanation of the Medals of Palmyra, published in London in 1782. The Researches of M. Silvester de *Sacy*, published in 1792, and the Mémoire of *Barthélemy*, sur l'Alphabet et sur la Langue dont on se servait antrefois à Palmyre, in the twenty-sixth vol. of the Memoires de l'Academ. des Inscriptions.

Pampre, (Fr.) an ornament composed of vine leaves and bunches of grapes, with which the hollow of the circumvolutions of twisted columns are sometimes decorated.

Pancarpi, (Gr.) garlands and festoons of fruit, flowers, and leaves; adorning altars, doors, vestibules, &c.

Pandroseium, see *Athenian Architecture* and *Acropolis.*

Panel, (*panelleum*, Lat.) a thin board having all its edges inserted in the groove of a surrounding frame. A *panel*, in masonry, is one of the faces of a hewn stone. See *Abaci.*

Pantameter, see *Bevel graduated.*

Pantheon, (Gr. *a temple dedicated to all the Gods.*) one of the most magnificent temples of ancient Rome, and the only one which has been preserved entire It is now converted into a Christian church, and is dedicated to *the Virgin Mary and all the Martyrs.* On the frieze of the portico is the inscription, *M. Agrippa, L. F. Cos. Tertium fecit.* It is of the Corinthian order. The form of this building is round, with a spherical dome, and its diameter within, and its height from the pavement to the grand aperture at the top, are each one hundred and forty-four feet. The inner circumference is divided into seven grand niches, worked in the thickness of the wall, of which six are flat at the top, and the seventh, opposite the door, arched. Before each niche are two fluted columns, each of one single block of antique yellow marble. As high as the grand cornice the whole wall is cased with different kinds of valuable marble in compartments, and the frieze is entirely of porphyry. Above the cornice arises an attic, in which are fourteen oblong niches, between each of which are four marble pilasters, and between these, tablets of various kinds of marble. Immediately from the cornice of the attic springs the spherical roof, which is divided by bands crossing each other like the meridians and parallels of a globe; between these bands and the opening at the top, a space of considerable width is left plain. To lighten the roof, the space between the bands was formed of nothing but lime and pumice stones. The roof was covered on the exterior with plates of gilded bronze. The walls were decorated with lead and brass, over which were carvings in silver. A flight of seven stairs led from the spring of the roof to the summit. The superb portico, which was ascended by eight or nine stairs, consists of sixteen Corinthian columns of granite, fourteen feet in diameter, eight standing in front, and having an equal intercolumniation all along. The tympanum was adorned with bassi relievi in brass, and the cross beams which supported the ceiling of the portico, as well as the doors, were covered with the same metal. In the course of ages this building has been often embellished and repaired. It suffered by fire in the reign of Titus, but was repaired by Trajan, Adrian, Antoninus Pius, Marcus Aurelius, and Severus. On the architrave is the following inscription:—IMP. CÆS. SEPTIMIVS. SEVERVS. PIVS. PERTINAX ARABICVS. PARTHICVS. PONTIF. MAX. TRIB. POT. XI. COS. III. P.P. ET IMP. CÆS. MARCVS. AVRELIVS. ANTONINVS. PIVS. FELIX. AVG. TRIB. POT. V. COS. PROCOS. PANTHEVM. VETVSTATE. OBRVPTVM. CVM. OMNI. CVLTV. RESTITIVERVNT. The statues and chief ornaments of the interior, with the vast quantity of bronze which adorned it, and the external plating of the roof, were carried away by Alaric and by Constantine II. Emperor of Constantinople. Benedict II. and Nicholas V. covered the roof with lead. Raffarelle, whose tomb it contains, and several other artists, left sums of money for its reparation. Urban VIII. did some repairs in a bad taste, but he carried away the brass which covered the cross-beams, and other robberies were committed to adorn the palaces of his family, the Barberini, and it was said, "quod non fecerunt *barbari* fecere *Barberini*." There was anciently another pantheon at Rome, in the form of a decagon, dedicated to Minerva, and measuring from angle to angle about twenty-two feet and a half; between the angles were nine round chapels, each dedicated to a different deity, and a statue of Minerva was over the gate. The Pantheon of Athens was first changed into a Christian church, and afterwards into a Turkish mosque.

PANTILES, see *Tiles*.

PANTOGRAPH, (Gr.) an instrument for copying, and diminishing or enlarging drawings. It was invented in the seventeenth century, and a description of it appeared at Rome, in 1631, under the title of "Pantographice, seu ars delineandi Res quaslibet per Parallelogrammum lineare, seu Cavum, Mechanicum, Mobile, &c." 4to. The inventor of the instrument, and the author of this work, is supposed to have been Christopher Scheiner, a Suabian jesuit. Various improvements have since been made to it. The figure of the pantograph now in use is shewn in Plate P. 3. *fig.* 7. It consists of four brass or wooden rules, two of them from 15 to 18 inches long, the other two half that length. On the exact fixing of the holes or joints, chiefly depends the perfection of this instrument. Those in the middle of the long rulers, at *e* and *d*, are to be at the same distance from those at the ends of the longer ones at *b*, and those of the short ones at *g*, so that when put together they may make an exact parallelogram. The joint at *b* must have a little pillar, round at the end, underneath, for the instrument to slide upon; of the two parts of the long rulers which extend beyond the parallelogram, one, *c*, should have a piece of lead, or some other heavy substance, attached to it by a moveable socket, so as to keep the instrument firm whilst in use, and at *f* and *a* should be sockets for pencils and points; that at *f* being moveable. The mode of using it is evident from the figure. A pantograph on an improved construction has lately been manufactured, and may be procured at the mathematical instrument makers.

PARABOLA, (Gr.) a conic section formed by a cone being cut by a plane which is parallel to a tangent plane to the curved surface of the cone. Any line parallel to the base is called a *double ordinate*. A line which bisects a number of double ordinates is their *abscissa*, and the point where it meets the curve is the vertex. To find the area of a parabola, between a double ordinate and the vertex, when the abscissa and double ordinate are given, we have only to multiply together the double ordinate and the abscissa, and two-thirds of the product will be the area required. Thus if the double ordinate be 36, and the abscissa 24: $36 \times 24 = 864 \times \frac{2}{3} = 466$ the answer. The *Cartesian Parabola* is a curve of the second order, made use of by Descartes, to find the roots of equations of six dimensions, by its intersections with a circle. Newton calls it a *trident.*

Parabolic Asymptote, a parabolic line approaching to a curve, but never meeting it, yet both being produced indefinitely, their relative distance becomes less than any given line. A *Parabolic pyramidoid*, is a solid figure, which was thus named by Dr. Wallis. *Parabolic space*, is the area contained between the curve of the parabola and a whole ordinate. A *Parabolic spindle*, is a solid made by the rotation of a semi-parabola about one of its ordinates. The *Parabolic spiral* or *Helicoid*, is a curve arising from the supposition of the axis of the common parabola bent into the periphery of a circle, the ordinates being portions of the radii next the circumference.

Paraboloid, (Gr.) a solid formed by the revolution of a parabola about its axis.

Paradigrammatice, (Gr.) an old term signifying the art of forming figures in plaster.

Parados, (Gr.) the grand entrance in the Grecian theatres, which conducted into the orchestra, and upon the stage.

Paradromides, (Gr.) hypæthral walks attached to the Greek palæstra. See *Xystus.*

Parallel, (Gr.) in Geometry, lines, surfaces, &c. which are every where equidistant to each other.

Parallel Rules, see *Instruments.*

Parallel Copings, have their upper surface parallel to the bed of the stone, as those which cover a gable.

Parallel Cut, a counter drain.

Parallelogram, (Gr.) any four-sided rectilinear figure whose opposite sides are parallel.

Parallelopipedon, or *Parallelopiped*, (Gr.) a solid which has six faces, each parallel to its opposite face, and all its faces parallelograms. Its contents may be always found by multiplying the breadth and length of its base and its height together. Half of a parallelopiped upon the same base is a rectangular prism.

Parameter, (Gr. from *παρα, through*, and *μετρεω, to measure,*) a constant right line in each of the three conic sections, called also *latus rectum.* The rectangle formed by the parameter and an abscissa, in the parabola, is equal to the square of the correspondent semi-ordinate; and in the ellipsis and hyperbola, the parameter makes a third proportional to a conjugate and transverse axis.

Parapet, (*parapetto*, Ital. *breastwork,*) a small wall of masonry or earth for support or railing to a quay, bridge, terrace, &c.

Parangon, a species of black marble, which the ancients procured from Egypt and Greece, and which they called also *basaltes.*

Parascenium, another name for the *Postscenium* in the ancient theatres.

Parastades, (*παραστάδες*, Gr.) the name by which the Greeks distinguished the *antæ* of their temples: a temple thus constructed was termed *ναος εν παραστασιν*.

Parastaticæ Imagines, a name given to the statues of the emperors placed at the gates and entrances of temples.

Parerga, (Gr.) a word sometimes used to signify the ornamental additions made to a principal work.

Parget, (from Lat. *parces*,) a name applied in a general sense to the several kinds of gypsum, which when slightly calcined, forms plaster of Paris, but more particularly applied to the gypsums brought from Derbyshire and Montmartre.

Pargeting, the plastering of walls. See *Pageting*.

Parlour, (Fr.) in the old monasteries, was a room for conversation, and adjoined the buttery and pantry at the lower end of the hall.

Parquetry, or *Marquetry*, a kind of joinery or cabinet work, for which the French are famous, and which attained perfection in the seventeenth century. A *parquet*, is an inlaid floor composed of small pieces of wood, either square or triangular, which are capable of forming by their disposition various combinations of figures. Two sorts of wood are generally employed, differing very little in shade. The library of St. Paul's, the floor of the British Museum, and some of the new apartments at Windsor, &c. exhibit fine examples of its use in England. When Carlton-house was fitted up, about forty years ago, the throne-room, and several others, were laid with a species of parquetry, like that in *fig.* 5. *pl.* P. 3. It was prepared at Paris, and was sent to London, in compartments of about three feet square. It was laid on joists of the common description; the compartments were joined together by groove-and-tongue, wrought with what are usually called match planes, and were fastened to the joists by oblique nailing through the tongued edges, so that no nails appeared on the surface, as is shown in *fig.* 6. The narrow diagonal pieces and square frame on the outside are put together with mortise and tenons, and grooved to receive flush panels.

Parsonage Houses, were formerly embattled and fortified, and had numerous offices and appendages, and sometimes a chapel. At Bucknor, in Kent, however, there is an example of one, being a mere hovel, built on the church.

Parthenon, see *Athenian Architecture*. Mr. Wilkins, (Atheniensia, p. 99,) has rectified several errors which occur in Stuart's description of the temple of Minerva Parthenon. Vitruvius, in a passage manifestly corrupt, has pointed out the Parthenon as an hypæthral temple, having two interior ranges of columns; and has been commonly followed by modern writers. "It is certain, that in later times there was a double order of columns within the cella of the temple: the circles made to mark the situations of the lower, still remain in the pavement. From these circles it appears, that the columns were nearly two feet two inches in diameter: the lower portion of one, whose diameter corresponded with this dimension, was lying within the cella. The method observed in fluting, proves this column to have been of the Doric order, but it is to be observed, that the lower part of the shaft was planed and not fluted, a circumstance which tends in some measure to invalidate its claim to the high antiquity of the other parts of the building. Reasoning from the examples of hypæthral temples, these columns are not commensurate with those of the peristyle, but considerably less in proportion. It will be easily shown, that this want of proportional bulk is an argument against the probability that the temple was hypæthral. In temples of this description, the height of the upper and lower ranges of the interior columns together, reached from the floor to within a certain distance of the roof. In the temple at Pæstum, the entablature of the upper columns ranged very nearly with the upper member of the external order. No probable extension of the proportionate height could bring a double range of columns, the diameter of the greatest of which was only two feet two, within a limited distance of the external cornice of the Parthenon," &c. In confirmation of these arguments of Wilkins against the antiquity of the interior columns, Mr. Walpole has a memorandum made from the information he obtained from a French artist of great merit, who had resided many years at Athens, containing a positive assertion, that the interior columns of the Parthenon, of which there were then remaining several portions, were of the lower Greek empire.

The particulars given in Wheler's description prove, that the interior peristyle was a modern work, essentially differing from that of the age of Pericles. In the disposition of the interior columns, as given by Stuart, some great errors are observed, both in their number, position, and dimensions. The floor of the cella around the wall is a little raised, but this is not a proof of the existence of an hypæthral, for in the hypæthral temple of Pæstum, the floor next the walls, instead of being raised, is sunk.

The pavement of the opisthodomus has the marks made by the hinges of the ancient doors, and it is so little above that of the posticum, that the rise of the step has been frequently overlooked. In conformity with Wheler's description, Stuart has introduced six columns, in two ranges, within the opisthodomus, although he says no traces remain. Now the walls of the opisthodomus are still existing, very nearly of their primitive height; the original pavement remains in a very entire state, and is formed of large marble slabs, a foot thick, but exhibits no appearance whatever of columns having been placed upon it; it appears unaccountable, therefore, that six columns "equal in bulk" to those of the exterior peristyles, should have perished, and left no trace behind. Wilkins expresses his conviction, that no columns ever existed in this situation, and that Wheler alludes to the columns of the posticum, which are six in number, and nearly equal in size to those of the peristyle. By supporting the roof, he merely meant that they upheld the marble ceiling between them, and the columns of the western front.

The roof of the Parthenon was unquestionably of timber; it was covered with marble sculptured so as to represent large tiles, after the mode observed in the temple of Jupiter at Olympia, as described by Pausanias, (v. 10.) and some are yet to be seen among the ruins.

Party Walls, partitions of brick between buildings, in several occupations.

Parvis, formerly a room over the church porch, where schools used to be held.

Passages, the parts of a building which lead from one room to another. When there is only one series of rooms in breadth, the passage must run along on one side of the building, and may be lighted by apertures through the exterior walls.

If there be more than one room in breadth, it must run along the middle, and may be lighted at one or both ends. When the building is very long, cross passages should be made, which will allow of giving additional light. In the upper stories of buildings, passages may be introduced in any direction which is convenient, as light may generally be admitted from above.

Pastas, (παστας, Gr.) a vestibule. In the expedition of the Argonauts, when Jason arrives at the palace of Hypsipyle, the servants throw open the folding doors, and conduct him through the vestibule, *δια καλης πασταδος*. (Apol. Rhod. i. 789.) Herodotus uses the word *παστας* to signify the vestibule, or pronaos, of a temple of Minerva, ii. 169. Pollux makes *exedra* and *pastas* synonymous terms.

Pastophori, (Gr. *παστος*, *a couch*, and *φερω*, *to bear*,) priests of an inferior order among the Egyptians, who carried the statues of the gods in solemn processions, and are often found sculptured and painted on Egyptian temples. The apartments where the *pastophori* lodged, were termed *pastophoria*. Clemens of Alexandria, describing the Egyptian temples, observes, "After having passed through magnificent courts, you are conducted to a temple, which is at the farther end of these courts, and there a *pastophorus* gravely lifts up the veil, which is the door, to shew you the deity within;" and Apulius speaks of the *pastophori* that carried the Syrian goddess.

Pate, in fortification, a kind of platform in shape of a horse-shoe, encompassed only with a parapet, and, having nothing to plank it, usually erected in marshy grounds to cover a gate of a town.

Patera, (Lat.) a vessel used in the Roman sacrifices, in shape of a dish, sometimes introduced as an ornament in friezes, &c.

Paternosters, rows of beads carved on mouldings.

Pavement, (*pavimentum*, Lat.) a path or road paved with stones, &c. The Carthaginians, according to Isidorus, were the first people who adopted the practice of paving their streets with stone. It was introduced into Rome, in imitation of them, by Appius Claudius Cæcus, who constructed the road called after him the *Appian way*. Afterwards the Roman roads were universally paved, and remains of them are found in every country which formed a part of the empire. See *Road*. The pavements in the interior of the Roman houses were often constructed upon stages or timber work, when they were called *contignata pavimenta*: the pavements which they called *coassationes*, were made of oaken planks of the *quercus æsculus*, which were considered to be least subject to warp. In some churches on the continent, the pavement is of marble, and in others mosaic, as in St. Mark at Venice. In France, the roads, streets, courts, &c. are paved with *gres* or grit-stone; and flag-stones, as in England, are not in use. In Amsterdam, and the chief cities of Holland, the carriage road, or middle of the street, is, as with us, paved with flint or stone, and the foot path at the sides with brick, and distinguished by the name of the *burgher-masters*.

The pavements of great streets in England are usually of flint or rubble stones. Pavements of free-stone, flint, and flags, are laid in a bed of sand; but in courts, or the interior of buildings, the pavement is usually laid in mortar made of sand and lime, or in cement. The chief kind of paving are *brick* *paving*, with bricks, either edgways or flat. *Granite*, which is universally used in London, and generally brought from Scotland—*Guernsey stone*, which is now much in use—*Marble*, often variegated, and inlaid with mosaic—*Newcastle flags*, about two feet square, and one and a half or two inches thick—*pebbles*, which when about three inches deep are called *bolders*, or *bowlers*—*Portland stone*—*Purbeck pitchers*, squared stones from the Isle of Purbeck, used in foot ways, generally from six to ten inches square, and five deep—*rag stone*, dug in the vicinity of Maidstone in Kent, and formerly used in London—*Ryegate* or *fire stone*, used for hearths, stoves, ovens, and other places which are liable to great heat—*squared paving*, first used in Scotland—*Sweedland paving*, a black slate dug in Leicestershire, and used in halls, &c.—*Yorkshire paving*, a stone of great use, and about the same thickness as the Purbeck, which is not affected by frost, or penetrated by wet. *Diamond pavements* have the stones or flags laid diagonally.

Pavement, *Tessellated*, a pavement of mosaic work used by the ancients, made of square pieces of stone, &c. called *tesseræ*. The Romans greatly delighted in this kind of ornamental floor, which succeeded, Pliny tells us, to the old painted pavements which originated in Greece. Many specimens have been found in various parts of England, as well as in every part of the continent which was under the Roman dominion. The tesseræ (or small dies) which compose the majority of such pavements as have been found in Britain, are in general nearly cubes, of about an inch square; but they are by no means invariably of that size. Some which are of mere brick, and were used for the coarse work of ordinary apartments, were much larger; while others, which were employed in filling up the minute parts of such pavements as were worked with great labour and delicacy, are exceedingly small. They were embedded in cement, and placed on prepared strata of different kinds, as rubble stones, or blended clay, sand, and loose pieces of brick, with brick-work for the foundation of the whole. The tesseræ are of various colours, and in many instances appear to have been formed of stones dug from the neighbourhood of the building in which they were placed, with the addition of small dies of brick to produce a red shade, and a hard calcarious stone, of a bright white hue, resembling Palombino marble.

Pavilion, (*paviglione*, Ital.) a turret or small building generally insulated, and comprised beneath a single roof. This name is also given to the projecting parts in front of a building which mark the centre, and which sometimes flanks a corner, when it is termed an *angular pavilion*.

Paul's, St. *Cathedral*, the metropolitan church of the diocese of London. Its site is believed to have been occupied in the time of the Romans by a temple dedicated to Diana, and horns and skulls have often been dug up, which are supposed to have belonged to the animals sacrificed to the divinity. One of the earliest Anglo-Saxon churches was erected here by Ethelbert in 610, after his conversion, and large sums were expended upon it by Erkenwald, the fourth bishop of London, who died in 685. The church was destroyed by fire in 961, and, when rebuilt, fell a victim to the same element in 1087, when Mauritius, bishop of London, conceived the design of erecting the magnificent building which preceded the present cathedral. It was not, however, entirely completed till 1240, having suffered severely from an accidental fire that happened in 1135, during the progress of its erection. It was repaired in 1633 by Inigo Jones, and after its destruction by the great fire in 1666, the present edifice was erected under the direction of Sir Christopher Wren. The ancient cathedral was one of the grandest works of the architects of the middle ages. The general plan was a simple cross with a long choir, and rather a short transept. The body of the church was a perfect specimen of Norman architecture; the nave was divided from the aisles on both sides by huge clustered pillars, which supported large semicircular arches; above them was an open gallery, with arcades resembling those below, but of much shorter proportion. Above the gallery was more modern work, with pointed windows and simple groins, with soffits and diagonal ribs only, like the transept of Westminster abbey. It was the opinion of Sir Christopher Wren, that this Norman building had been erected upon the remaining foundations of the more ancient Saxon church, as he found them composed of Kentish rubble-stone, cemented with extremely hard mortar, both greatly superior to the materials of the superstructure. The choir and lady's chapel were of the Gothic style, and were fine specimens of the architecture of the reign of Henry VIII. At the intersection of the nave with the transept, four massy pillars supported the tower, which was of great height, and built in the early Gothic style; and various masses of building, in the shape of enormous buttresses, had been added at different periods, to secure it from falling. At the western front, Inigo Jones had erected a portico of the Corinthian order, so that the whole building displayed a varied pile of the architecture of different ages and countries. Dependent on it were the chapter-house, a beautiful octagonal building of the pointed style, and the *clocher*, or bell-tower, a very ancient building at the east end of the church-yard.

The design of Sir Christopher Wren was at first restricted to a moderate size, consisting of a choir, vestibule, porticos, and a lofty dome, in the Roman style of architecture. This being not univerally liked, he formed another design, of which a highly finished model was made in wood, which has been deposited in a room over the morning-prayer chapel of the present cathedral. The third design was produced in its present form, and the work was begun on the first of May 1675, the first stone being laid on the twenty-first of June following. In 1710, the last stone at the top of the lantern was laid by Mr. Christopher Wren, the son of the architect. A large plan of this edifice was published by Gwyn, and descriptions, plans, and drawings, may be found in various architectural publications. See *Dome*, and *St. Peter's*.

PAUTRE, *Antony le*, a French architect, who was born in 1614 at Paris, and died in 1691. His chief works are the wings of St. Cloud, the church of the nunnery of Port Royal, and the hotels of Gevres and Beauvais. The first edition of "*Les Œuvres d'Architecture d'Antoine le Pautre*," appeared in 1652.

PECTINATUM TECTUM, a kind of roof among the Romans, which was shaped like a comb, and threw off the water in two ways.

PEDESTAL, (Fr. from *pes*, Lat.

a foot,) the square support of a column, statue, &c. and the base or lower part of an order of columns. When the height and width are equal, is termed a *square pedestal*; one which supports two columns, is a *double pedestal;* and if it support a row of columns without any break, it is a *continued pedestal.* The lowest and most simple kind of pedestal, is the *Tuscan.* Palladio and Scamozzi give it three modules in height: Vignola, five. According to the latter writer, it consists of a plinth for a base, the die, and a talon crowned for a cornice. The *Doric* order has in antiques no pedestal or base: Palladio gives it a pedestal, four modules five minutes high, which is increased by Vignola to five modules four minutes. In the temple of Fortuna Virilis, the *Ionic* pedestal is seven modules twelve minutes: Scamozzi makes it five, and Vignola six modules. Its members and ornaments, as well as those of the Doric, differ little from those given to the Tuscan. In the Coloseum, the *Corinthian* order has a pedestal four modules two minutes in height: Palladio gives the height of the Corinthian pedestal at five modules one minute; Vignola, seven modules; and Serlio, six modules five minutes. The *Composite* pedestal has much the same dimensions as the Corinthian: Scamozzi makes it six modules two minutes, and Palladio six modules seven minutes. Pedestals should never be employed with detached columns forming porticos, but they are frequently applied to columns which divide arches, and are necessary in churches, where the pews would otherwise conceal the base, and great part of the columns. They may be introduced with propriety, likewise, in all edifices built for the reception of crowded assemblies. The best method of arranging pedestals is that employed by Vignola, who makes them in all three orders, one third of the height of the columns.

Pediculus, in the middle ages, a kind of prison, in which the feet were bound in chains.

Pediment, (from *pes*, Lat. *a foot*,) an ornament generally of a low triangular form, which crowns the ordonnances, finishes the fronts of buildings, and is used as a decoration of windows, doors, &c. A pediment is more properly speaking the angular end of a building which surmounts a portico. The entablature, in this case, is covered by two straight inclined cornices, the mouldings of which are similar to the horizontal one: the space enclosed is called the *tympanum.* This was the original pediment, and the only form found in Greece; but the Romans, to vary the form, employed, in smaller works, a segment of a circle, instead of the triangle. This form, however, is heavy, and is only used as a covering to gates, doors, windows, and such smaller architectural works, where, by reason of its minuteness, it produces variety, without being disagreeable to the eye. The following method of determining the height of a pediment has been given in a French pamphlet. From the summit of an equilateral triangle, of which the base is the upper fillet of the horizontal cornice, with one side of the triangle as a radius, describe an arc. With the point of intersection between this arc and the centre line of the composition as a centre, and with the depth of the horizontal cornice as a radius, describe a part of a circle: a line drawn from the extreme boundary of the upper moulding of the horizontal cornice, making a tangent to the circle, gives the inclination of the pediment. See *Ætoma*, *Eagle*, *Fastigium*, *Gable*, *Tympanum*.

Pegmata, see *Antepagmenta*.

Pelecoides, (Gr.) a mathematical figure in form of a hatchet, contained under two inverted quadrantal arcs and a semicircle.

Pend, in Gothic architecture, a vaulted roof without groining.

Pendant, a hanging ornament in very rich Gothic groined roofs. See *Gothic Architecture*.

Pendent Bridge, a wooden bridge, with butments only at the ends, and supported by posts and pillars.

Pendentive, the whole body of a vault, suspended out of the perpendicular of the walls.

Pendentive Bracketing, or cove bracketing, springing from the rectangular walls of an apartment upwards to the ceiling, and forming the horizontal part of the ceiling into a circle or ellipse.

Pendentive Cradling, the timber-work for sustaining the lath and plaster in vaulted ceilings.

Penetrale, (Lat.) the most sacred part of a temple, which generally contained an altar dedicated to Jupiter Hercæus, who derived his appellation, according to Festus, from ἑρκος, *an enclosure*, and was the supposed protector of its sanctity. And thus Ovid alludes to the death of Priam, who was slain at the altar of Hercæan Jupiter, (in Ibin. 283:)—

> Nec tibi subsidio sit præsens numen: ut illi,
> Cui nihil Hercæi profuit ara Jovis.

And from Virgil it appears that this altar was in an hypæthral atrium, and shaded by a laurel tree, (Æn. ii. 512) There was an altar of Hercæan Jove in the temple of Minerva Polias at Athens, (Dionys. Halicarn. in Dinarcho. p. 113.) and it was under an olive-tree, (ὑπο τῃ ἐλαιᾳ) and consequently must have been in that part exposed to the open air. Diodorus Siculus speaks of a βωμος ὑπαιθριος, hypæthral altar, in the midst of the peristyle of a temple of Jupiter at Thebes, and the Iliac table represents Priam slain at an hypæthral altar in the midst of an internal peristyle.

Penetralia, (Lat.) small chapels in the innermost part of the Roman houses, dedicated to the *penates* or household gods, in which they used to deposit whatever was held most valuable.

Penetentiaries, amongst the monks, were small square houses, in which the penitent shut himself up, sometimes in a grove near a river, and at a distance from towns.

Pent Roof, see *Roof*.

Pentadoron, (Gr.) a kind of bricks among the Greeks, which were five *palms* long, and which they employed in their public edifices.

Pentagon, (Gr.) in Geometry, a figure of five sides and five angles.

Pentagraph. See *Pantograph*.

Pentapastos, (Gr.) a machine mentioned by Vitruvius, which was used to raise great weights, such as stones, to a certain height, in building.

Pentastyle, (Gr.) having five columns in front.

Peperino, (Ital.) a kind of stone found in the environs of Rome. That found in the neighbourhood of Alba is generally known by this name, whilst that found near Tivoli is called *travertino*. Both sorts, on account of their fine quality, were much used by the ancient Romans. The first is found in an ancient tomb near Albano, and the latter in the great cloaca of Rome, in the foundations of the Capitol, and in the column termed *rostrata*.

Perambulator, (Lat.) an instrument for measuring distances in travelling, by being attached to the wheel of a coach, &c.

Perclose, or *Parclose*, in the architecture of the middle ages, signified a closet.

Pergula, (Lat.) the name given among the Romans to that part of a house now called the gallery. By Vopiscus it is termed *magistralis*. In Plautus, the term is used for the balcony of a house, where the courtezans were accustomed to place themselves, more readily to attract notice. The *pergula* was sometimes a portico for training vines and creepers, ranged along the back front of the windows of the triclinium, (*Pompeiana.*) Winckelmann says, that in its most customary sense, it meant a bower elegantly formed of reeds fastened across. It was also a short walking place, where artificers exhibited their goods.

Periacti, (from περιαγειν, Gr. *to revolve*,) the revolving scenes of the theatre, called by the Romans *scenæ versatiles*.

Peribolos, (Gr.) a court or enclosure within a wall, sometimes surrounding a temple. It was commonly adorned with statues, altars, and monuments, and often contained other smaller temples, or a sacred grove. The peribolos of the temple of Jupiter Olympius at Athens, was four stadia in circumference. The temple of Apollo Didymæus, near Miletus, was surrounded by a peribolos and a sacred grove, some of the trees of which still exist. Round temples had sometimes also their peribolos, as we see by the temple of Jupiter Serapis, at Puzzuolo, or Puteoli.

Peridrome, (περι, *around*, and δρομος, a *course*, or *parade*,) that part of the periptere, which was left between the columns and the walls, and which served among the Greeks as a promenade.

Perimeter, (Gr.) the bounds of any figure.

Periphanes, or *Prostypon*, (Gr.) a term by which are sometimes designated figures and ornaments sculptured in very high relief.

Periphery, (Gr. from περιφερω, *I surround*,) the circumference of a circle, ellipsis, parabola, or other regular curvilinear figure.

Periptere, (Gr.) a range of insulated columns distant from the wall an intercolumniation, which surrounded the exterior of a temple.

Peripteral, a temple surrounded with a periptere, which is the fourth kind in the classification of Vitruvius. They were occasionally both round and square. See *Temple*.

Perirrhanterion, (Gr. from περιραινω, *to sprinkle*,) a kind of vases placed at the entrances of ancient temples, which were filled with pure water, with which the priests both washed their own hands, and sprinkled such as entered. In the Pitture d'Ercolano, vol. v. pl. 69, are seen two lustral vases at the gate of a religious edifice, in each of which is a branch of laurel.

Peristyle, (Gr.) a range of columns within a court or building, as the internal colonnade of an hypæthral temple. One of the courts of the Roman villas, which was defended from the rays of the sun by a colonnade, was called a peristyle. See *House*. According to Vitruvius, it should have in length one and a half its breadth.

Peristylium, (Gr.) a large rectangular space in the middle of the Athenian gymnasia, for walking, and performing the exercises not peculiar to the palæstra.

Peritrochium, (Gr.) a term in Mechanics, given to a wheel or circle, concentric with the base of a cylinder, and together with it moveable about an axis.

Perpendicular, (Lat.) a right line standing on another, so as to make right angles with it, or to make the angles on each side the same. One plane is perpendicular to another, when a line in it is perpendicular to the other plane. A *perpendicular to a curve*, is a right line which cuts the curve in a point, where another right line, to which it is perpendicular, makes a tangent with the curve.

Perpent Stone, *Perpender*, or *Perpin*, (Fr.) a long stone, intended to reach through a wall, so as to be visible on both sides, and therefore wrought and smoothed at the ends.

Perpeyn-walls, a term applied in the Monasticon to two walls in Fotheringhay church, which divided the body from the aisles: probably it meant walls finished alike on both sides.

Perrault, Claude, born at Paris in 1613, was at first brought up to the medical profession, and took his degree as doctor in 1641: but he was afterwards led by his taste to turn his attention to the study of architecture, and in 1666, was appointed to select a spot, and gave a plan, for the erection of the Observatory of the Academy of Sciences, of which he was one of the first members. His master-piece was the façade of the Louvre, executed under Louis XIV. He also furnished a design for a grand triumphal arch, which was begun, but never furnished. Amongst his other works are the chapel at Sceaux, that of Notre Dame, in the church of the Petits Pères, in Paris, &c. Perrault published a translation of Vitruvius, with notes, in 1673. He also published "Ordonnance des Cinq Espèces de Colonnes, selon la Méthode des Anciens," and several works on other subjects. He died at Paris in 1688, at the age of 75.

Perron, (Fr.) a staircase lying open, or without-side the building; more properly the steps in the front of a building which lead into the first story, where it is raised a little above the level of the ground.

Perronet, John Rodolphus, a French architect, born in 1708. In 1745, he was made inspector of the school of engineers, and afterwards director of the bridges and roads of France. His services were rewarded by honouring him with the order of St. Michael, and he was admitted a member of the Academy of Sciences at Paris, of the Royal Society of London, and of the Academy of Stockholm. He published a description of the bridges which he had constructed, in 2 vols. 12mo. and Memoirs on the Method of constructing great Arches of Stone, from two hundred to five hundred feet in span. His death took place in 1794, at Paris.

Persepolis, the ancient capital of Persia, of which now only a few ruins remain; which are supposed to be chiefly those of a palace. The great plain of Merdasht (Mervdasht) or Istakhr, in which the ruins are situated, is one of the most fertile in Persia, being watered in all directions by rivulets and artificial drains, which ultimately unite in the Bundemir, the ancient Araxes. The artificial plain on which the ruins of the immense royal citadel or palace stand, is of a very irregular shape. The extent of each face is, that to the south eight hundred and two feet, to the north nine hundred and twenty-six, to the west one thousand four hundred and twenty-five. The level has become exceedingly uneven by the accumulation of fallen ruins. To the north-west considerable masses of the native rock shew themselves, still bearing the marks of the original implements with which the higher pieces had been hewn down to the level required. In deeper cavities, the progress of a quarry is visible, part of the rock in some places being half hewn through, and in others, lying in completed slabs ready for removal. The steep faces of the rocky terrace are formed of dark grey marble, cut into gigantic square blocks exquisitely polished, and, without the aid of mortar, fitted to each other with closeness and precision. At a spot near the group of columns, its present perpendicular line is thirty feet; but there can be no doubt that, might we clear away all that hides this beautiful wall, we should find an additional depth of twenty feet. This spacious artificial platform consists of three separate terraces. The first, or lowest, embracing the whole length of the southern face, is one hundred and eighty-three feet wide. Along the edge, large masses of stone remain in different spots, with fragments of a parapet. On the edge of the third or highest southern terrace, are marks of a strong range of railing or palisadoes. At the top of the steps which connect this terrace with the one beneath, are found two large holes, cut deeply in this stone, which received the pivots of the gates that anciently closed this ingress. The steps are composed of immense blocks of marble, each block being so large as to allow ten or fourteen steps to be cut into its solid mass. On reaching the platform, the first objects that strike the astonished traveller, are the lofty sides of an enormous portal, the interior faces of which are sculptured into the forms of two colossal bulls. A pedestal elevates them five feet above the level of the platform. At a considerable height above their backs are three small compartments filled with inscriptions in the arrow-headed character. Proceeding onward to the east, twenty-four feet from the portal, was a fine group of columns: they were all erect in Chardin's time, but when Sir Robert Ker Porter visited Persepolis, two only remained, and not a relic of their companions. They were placed equidistant from each other, at twenty-two feet. Their bases are buried in the ruins: their capitals are singular and beautiful, consisting, as it were, of three combined in one. The shaft gradually narrows toward the top, varied by thirty-nine flutings near the cincture; each of which is four inches in width. A space of twenty-four feet separates them from a second portal, resembling the former both in shape and dimensions, except that its length is eighteen feet instead of twenty-one. The inner sides are sculptured in like manner, but the animals represented have the body and legs of a bull, an enormous pair of wings projecting from the shoulders, and the heads, looking to the east, showing the faces of men. On the head is a cylindrical diadem, on both sides of which horns are clearly represented winding from the brows upwards to the front of the crown; the whole being surmounted with a sort of coronet, formed of a range of leaves like the lotus, and bound with a fillet beautifully carved in roses. An agate seal, brought by Niebuhr from Basrah, and supposed to be of the highest antiquity, exhibits the winged bull with a human head. A similar device appears upon a cornelian brought from Shiraz by Sir W. Ouseley, as well as on many Greek medals, gems, and bronzes; but this is the only instance in which such a representation is known to exist in Persia in marble. Mons. Anquetil du Perron advances very cogent reasons for supposing it to be a symbolic representation of Noah! Sacy thinks it the emblem of Kaiamurs, the first sovereign of the Paishdadian dynasty, and he derives his name from Gaw-i-mird, bull and man. Three compartments of inscriptions are cut in the wall over the figure. At the distance of one hundred and sixty-two feet from this portal is the magnificent terrace which supports the multitude of columns from which it takes its name. "On drawing near the Chehel-minar, or Palace of Forty Pillars," says Sir Robert Ker Porter, "the eye is riveted by the grandeur and beautiful decorations of the flight of steps which lead up to them. This superb approach consists of a double staircase, projecting considerably before the northern face of the terrace, the whole length of which is two hundred and twelve feet: at each extremity, east and west, rises another range of steps; and again, about the middle, projecting from it eighteen feet, appear two smaller flights rising from the same point. Here, the extent of the range, including a landing-place of twenty feet, amounts to eighty-six. The ascent, like that of the great entrance from the plain, is extremely gradual; each flight containing only thirty-two steps (none exceeding four inches in height,) in breadth fourteen inches, and in length sixteen feet. The whole front of the advanced range is covered with sculpture. The eye at first roves over it, lost and bewildered by the multitudes of figures." Amongst these sculptures the bull and the lion often occur, and not unfrequently the flower of the lotus. This flower was alike sacred in Persia, India, and Egypt. The Egyptians introduced it into the architecture of their temples. It is the *fleur-de-luce* of the arms of France; and Sir R. K. Porter remarks, that in all pictures of the salutation of the Virgin, this flower is introduced.

"On ascending the platform on which the palace of Forty Pillars once stood, nothing can be more striking than the view of its ruins, so vast and magnificent, so fallen, mutilated, and silent,—the court of Cyrus, the pavilion of Alexander's triumph, and the memorial of the wantonness of his power!" This immense upper platform stretches north and south 350 feet, and from east to west 380. The greater part is covered with broken capitals, shafts of columns, and innumerable fragments of building, many of them richly sculptured. The distribution of the columns comprised four divisions, consisting of a centre phalanx of six feet deep every way, an advance body of twelve in two ranks, and the same number flanking the centre. The form of the columns which compose the three distinct colonnades, is the same in all. The total height of each column is sixty feet; the circumference of the shaft sixteen feet; and its length from the capital to the base forty-four feet. At its lower extremity begin a cincture and a torus, the former two inches deep, the latter one foot; whence devolves the pedestal in the form of the cup and leaves of a pendent lotus. It rests upon a plinth of eight inches, and in circumference measuring twenty-four feet six inches; the whole from the cincture to the plinth, comprising a height of five feet ten inches. The capitals which remain, though much injured, "show that they were all surmounted with the double demibull." The columns of the central phalanx are only fifty-five feet high, and differ considerably from the others; the shafts are fluted, and about thirty-five feet in length; the capitals resemble those of the great portal, of which a figure is given in Pl. *Castle*, C. 70. *fig*. 5. The two lower divisions are evidently constructed of the hallowed lotus; the upper compartment has only two volutes. The nearest building now standing to this palace, appears on an elevation about seven or eight feet above the level of the plane of the colonnades, and measures one hundred and seventy feet by ninety-five. It is approached from the west by a double flight of stairs, which, from the fragments that remain, appear to have been sculptured like those of the great platform; the eastern side is buried in fallen ruins; to the south the whole face of the terrace is occupied by another superb flight, the landing place of which embraces nearly forty-eight feet by ten. The platform around the building is covered with ruins of walls, majestic portals, with colossal statuary, &c. From the western landing-place two portals lead into a room forty-eight feet square; it has two doors on the north, two to the west, one to the south, and originally two to the east. On three sides of the room are several niches, each excavated in one solid stone, to a depth of three feet, five feet high, and six feet wide; they appear to have been exquisitely polished within, while upright lines of cuneiform characters run along their edges. Four windows, ten feet high, open to the south. There is another apartment of the same building, thirty feet by forty-eight, open to the south.

Another elevation occurs at about ninety-six feet to the south of the preceding; but its buildings, which appear to have been of a similar description, are in a more dilapidated state even than the former. Immediately beyond this terrace rises a fifth, and a much more extensive elevation, on which stand the remains of one of the most regularly planned structures of the whole platform. Of the vast edifice which once stood upon it, the principal doorways and huge marble window-frames are yet in their places; their lofty sides and ponderous lintels resemble, though with the finest workmanship, our druidical monument at Stonehenge. The windows and portals are covered with bas-reliefs. Amid the ruins, beneath the pavement, may be traced a subterraneous aqueduct. At the sides of the open court stand the remains of its once magnificent approaches. About sixty feet farther to the north, appear several colossal masses of stone, forming the sides of large portals, leading into a square edifice, which appears, from the situations of the doors on each side, to have been of but small dimensions. About one hundred and sixty feet to the south-east of it is another pile of ruins, which marks the site of a once magnificent building, only now to be traced by the foundations, portals, and parts of the walls. Other buildings of the same character are traced in every direction.

The foregoing account is abridged from the description given by Sir Robert Ker Porter. Immediately behind the *Takht-i-Jemsheed*, or seat of Jemsheed, the name given by the modern Persians to the whole platform, are two tombs excavated in the mountain, between three and four hundred yards apart, the front of each finely sculptured. Each contains a chamber about thirty feet wide, fifteen or eighteen deep, and ten or twelve high. About three quarters of a mile southward is a third tomb, which has never been finished, although apparently the most ancient. About a mile and a half, or two miles, to the north in another chamber in the rock, which, from the supposed reference to its sculptures, has obtained the appellation of *Naksh-i-Rajab* (the portrait of Rajab :) and four miles from the platform are the sculptured tombs called by the natives *Naksh-i-Rustam* (the portrait of Rustam.) Besides the work of Sir Robert, the reader may consult the works of Ouseley, Morier, Niebuhr, le Brun, Chardin, Kæmpfer, and della Valle. See *Persian Architecture.*

Persians, or *Caryatides.* See *Caryatides.* The authenticity of Vitruvius' story about the origin of the term Caryatides, and the history of the Caryatic war, were first questioned by Lessing, the German antiquary, (Kleinere Antiquarische Aufsätz, band x. p. 369.) The use of similar supporters in Egyptian buildings convince us of the antiquity of the practice. A bas-relief found near Naples, representing two Caryatides about three feet high, bears this inscription :—ΤΗΙ ΕΛΛΑΔΙ ΤΟ ΤΡΟΠΑΙΟΝ ΕΣΤΑΘΗ ΚΑΤΑΝΙΚΗΘΕΝΤΩΝ ΤΩΝ ΚΑΡΥΑΤΩΝ. "This trophy has been raised to to Greece, on the conquest of the Caryates." But it is not of sufficient antiquity to afford any more authentic argument than the passage of Vitruvius. In the Athenian inscription, (see *Minerva Polias*,) the Caryatides of the temple of Minerva Polias, are called ΚΟΡΑΙ, virgins, which tacitly disproves the story of Vitruvius : and in the description of this temple by Vernadæ, the Venetian engineer at the siege of Athens in 1687 ; it is said to be "sostenute da quattro statue di marmo, quale rappresentano le Grazie che Socrate fece far vestire per burlarsi di quelli, che le hanno rappresentate nudo," (Fanelli, Atene Attici,) sustained by four statues of marble which represented the Graces, who were represented by Socrates clothed. Very few examples have been known of the use of Caryatides or Persians by Grecian architects. Of the use of Persians, or male figures, called also Telamones and Atlantes, we have an example in the temple of Jupiter at Agrigentum, (see *Agrigentum,*) where they resembled the attached Colossi in the Memnonium temples of Thebes ; they were twenty-five feet high, and appear to have supported the roof in the interior of the temple. The Persian portico at Sparta, described by Pausanias, was decorated with figures of Persians, amongst which was Mardonius, on columns, and they are called by Vitruvius "captivorum simulachra," statues of captivas. This portico has been likened to an edifice now known by the name of the Incantada, at Thessalonica, but in this building the statues represent mythological personages, as Ganymede, Leda, Telephus, &c. The statues or canephoræ of the Pandroseum resemble, in costume, the Attic virgins in the Panathenaic frieze, and have no characteristics of degradation in their composition. Details of these statues will be found among the plates of *Athenian Architecture.*

The dress of the Persians upon

the frieze of the temple of Victory, now in the British Museum, consists of a very full tunic, and of a pair of loose pantaloons enveloping the feet. It appears from Persius, that they were represented in the same manner in the Pœcile, for the satyrist calls that Stoa, *braccatis* illita Medis porticus.

Persian Architecture. The ruined monuments of the architecture of the ancient Persians, cannot be regarded as models of the art, but they are important to the antiquary, and the artist. The style differs, though it bears at the same time a great resemblance to that of the Egyptians and Indians. The resemblance is particularly traced in the massive proportions, in the absence of arches, in the pyramidal inclination of many of the buildings, and more particularly in the vast artificial excavations that are found in the mountains. They differ most particularly in the order of the columns, &c. For the sake of comparison, we have given, in plate *Castle* C. 70, *fig.* 5 and 6, capitals and *fig.* 7 a base, from Persepolis; A, B, and C, are details of *fig.* 5. In these columns are traced not only the lotus capitals of Egypt, but the scroll, so characteristic of the Ionic, and the fluting of the Doric and Corinthian orders of Greece. But the buildings of the cities, it may be supposed, were comparatively more modern works, and it is in the excavated works of a remoter age that we might expect to find the most striking similitude to the very ancient architecture of India or Egypt. The chief remains of Persian architecture are found at Persepolis, which have been already described under that article. We shall here describe such other remains as may combine with them in giving some idea of the ancient buildings of the Persians.

Amongst the ruins called *Takht Taous*, the peacock throne, stands a solitary column, surrounded by the broken shafts, bases, and capitals of others, all resembling those at Persepolis. The column is fluted like the Doric, but with lines more closely connected; it is one foot eight inches in diameter at the bottom, and six inches less at the top, a little above seventeen feet in height, and the base, including a torus, two feet more. The capital is in the form of the head, breast, and bent fore-legs of a bull, richly ornamented with collars and trappings, united at the back to the corresponding bust of another bull, but leaving a cavity between, sufficient to admit the end of a square beam. On the site of Pasargadæ a pillar still erect is described by Mr. Morier, as a plain shaft without a capital, ten feet five inches in circumference. In the interior of a modern bath at Kermanshah, given by Mr. Buckingham, are columns with capitals exactly, and bases very nearly, resembling those at Persepolis, but the shafts are fluted *spirally*. (Travels in Assyria, &c. p. 98.) The modern columns of the royal palace of Shah Abbas at Ispahan, are also spirally fluted.

Sir W. Ouseley observed amongst the ruins of the site of Darabgerd, walls and *arches*, still twenty feet high, the remains of an ancient aqueduct.

An extraordinary building amongst the ruins of Pasargadæ is described by Mr. Morier. "It rests upon a square base of large blocks of marble, which rise in seven layers, pyramidically. It is in the form of a parallelogram; the lowest range of the foundation is forty-three feet by thirty-seven; and the edifice itself, which crowns the summit, diminishes to twenty-one feet by sixteen feet five inches. It is covered with a shelving roof, built of the same massy stone as its base and sides, which are all fixed together by clamps of iron. Around it, besides a great profusion of broken marbles, are the shafts of fourteen columns, once, perhaps, a colonnade, but now arranged in the square wall of mud which surrounds the whole remains." In the interior was a small chamber, but not at all remarkable. He thinks it to be the tomb of Cyrus. The Mahometan writers call it the tomb of the mother of Solomon. Hafiz Abru says—"There is likewise another place in the district of Istakhr, on the road to Aberkuh, called the *Meshekd-i-Mader-i-Suliemam*, on whom be peace! Here also are stones of considerable size, and sculptured in a wonderful manner; the work, as it is related, of those *jins* (genii) who were subservient to Solomon, on whom be peace!"

The entrances to the excavations of the *Naksh-i-Rustam* are near 60 feet from the level ground. Sir W. Ouseley thinks them coeval with the palaces of Persepolis, though much of the sculpture has been added during the Sassanian dynasty. The tomb least difficult of access, being the last to the left, was explored by Sir W. Ousely, and is described as a chamber, thirty-five feet long, seven broad at each end, and eight in the middle. "This measurement does not include the depth of three arched recesses, hollowed like the chamber itself, in the solid rock, and forming sepulchral vaults nine feet long by five feet and a half broad. Immense slabs of the same rock cover the vaults; these it would be impossible to lift, or even move, without the assistance of several men. There is a fracture in one vault, made probably by the violators of these tombs, who, we may suppose, while taking out the body in search of treasure, raised and propped the stone cover, until having accomplished their object, they let it fall into its original situation. Through the aperture it was easy to ascertain that this vault contained nothing more than some pieces of stone. Within this chamber, of which the ceiling is arched like the recesses, and about ten feet where highest, all parts are of the plainest execution." In the same range of mountains, near the village of Hajji-abad, other caverns and sculptured rocks are found. The place is called *Zendau Jemsheed*, the prisons of Jemsheed. The first cave is apparently natural. The second is a deep indentation into the mountain, at the entrance of which the rock has been smoothed and cut into five tablets, each containing Pahlavi inscriptions. The third is celebrated for its great depth, but "has nothing artificial about it." Opposite the *Naksh-i-Rustam* is a square building of about twenty-four feet broad, and nearly thirty-five feet high, constructed of white marble "in a most substantial manner." A small doorway, about eleven feet from the ground, leads into a chamber, twelve feet three inches square, and about twenty feet high. The ceiling is composed of two immense marble slabs. The walls are entirely destitute of ornament. In the walls, externally, are many small oblong perpendicular niches, but none sink deep into the stone. Some of the natives assure the traveller that it was "the Kaabah of Zaratusht," (Zoroaster.) Mr. Morier and Sir R. K. Porter think that it was a fire temple, and described the interior as exhibiting signs of fire and smoke. A cornice enriched with dentils, passes round the summit: the cornice, on the northern face, is formed by one single slab, which is twenty-two feet six inches long. Not far distant, following the abrupt turn of the rocks towards the east, are two fire altars, four feet and a half square, and between five and six feet high, narrowing upward, and formed from a protuberance of the rock. On the top of each is a square cavity, eight inches deep, supposed to be the receptacle of the sacred fire. The eminence on which they stand is called *Sang-i-Sulieman*, Solomon's stone. At a few miles from Servistan is a ruined fortress called the *Kalaa àtesh kadah*, (Castle of the Fire-temple.) The fire-altar, which gives name to the castle, and which is a few hundred yards from it, is described by Sir W. Ouseley as a single upright stone, between ten and eleven feet high, and three feet and a half square at the bottom, diminishing a little towards the top. On the south and western sides are traces of Pahlavi inscriptions. On the top is a deep hollow, designed to receive the vessel containing the sacred fire. A rude low wall or fence of large stones encloses the altar, having a narrow entrance on the south. The first view brought strongly to his recollection the Druidical remains he had seen in Wales and Ireland ; and a few old trees seemed to represent one of those sacred groves which were, in early ages, attached to religious structures. At four miles from Fassa, the same writer observed, "on the right, and crowning the summit of a hill, an object which resembled, on a distant view, one of our British Druidical *cromlechs*." It "is called *Khaneh-i-Gabran*, the mansion of the fire-worshippers. It is a mass of stone, or rather of the harder cement, in which stones of different kinds and colours are thickly incrusted, of an irregular oblong form, about fifty feet long, and twelve or thirteen feet high, with a passage through it." Sir W. Ouseley observed, on the site of the ancient Darabgerd, an irregular cluster of large rude stones, on a rising ground in a part of the enclosed area, which, from its appearance, he says, "a British antiquary might be almost authorized to pronounce Druidical." Some of them are from twenty to twenty-five feet high. One, very tall, stands nearly in the middle; another, towards the west, resembles a table or altar, being flat at the top; and under two or three are recesses or small caverns.

The modern architecture of Persia, which resembles that of most Mahommetan countries, will be best understood by a description of the principal buildings of Ispahan, or Isfahaun, the former capital. The college called *Medressé Shah Sultan Hossein*, is on the right of the Meidan. Its entrance is handsome: a lofty portico, enriched with fantastically twisted pillars, and intermixed with the beautiful marble of Tabreez, leads through a pair of brazen gates, finished with silver, and their whole surface highly carved and embossed with flowers and verses from the Koran. The gates lead to an elevated semi-dome, which opens at once into the square of the college. The right side of this court is occupied by the mosque, which is still a beautiful building, covered with a cupola, and faced with two minarets. The interior of the dome is richly spread with variegated tiles. The other sides of the square are occupied, one by a lofty and beautiful portico, and the remaining two by rooms for the students, twelve in each front, arranged in two stories.

"The quiet and retirement of this college," says Mr. Morier, "the beauty and serenity of the climate, and the shrubbery and water in the courts, would have combined to constitute it in my eyes a sanctuary for learning, and a nursery for the learned, if it had been in any other country." The palaces of the kings are enclosed in a fort of lofty walls, which have a circumference of about three miles. The palace of the *Chehel Sitoon* (forty pillars) is in the middle of an immense square. The first saloon is open towards the garden, and is supported by eighteen pillars, all inlaid with mirrors. Each pillar has a marble base, carved into the figures of four lions. The walls are also covered with mirrors, and the ceiling is painted in gold flowers. From this saloon, an arched recess, studded in the same manner with glass, leads into an extensive hall, the ceiling of which is arranged in a variety of domes and figures. From the garden of this palace, an intricate passage leads under an octagonal tower into the harem, called *Amaroot Noo*, the new palace, which is in the same style of building. From the interior of the palaces we ascend the *Ali Capi* gate, which forms the entrance. "This gate, once the scene of the magnificence of the Sefi family, the threshold of which was ever revered as sacred, is now deserted; and only now and then a solitary individual is seen to pass negligently through. The remains of that splendour so minutely and accurately described by Chardin, are still to be traced; the fine marbles remain, and the grandeur and elevation of the dome are still undemolished." The houses of Ispahan are only one story high, but are composed of so many compartments, that the meanest of them occupy a considerable area. They are built of earth or brick, and their uniformity in height and colour produces a dull appearance. The *Shah Meidan*, or royal square, with its bazaars and religious edifices, rivals any in Asia. Its length is four hundred and forty paces by one hundred and sixty in breadth. On the south side stands the royal mosque, a magnificent building erected by Shah Abbas, in the sixteenth century. It is entered by a gate twelve feet wide, closed by two leaves, covered with plates of solid silver, partly gilt and sculptured. The whole edifice is constructed of massy stone, covered with highly varnished bricks and tiles. Within are fountains flowing into jasper basins, spacious courts, and extensive porticoes, of which that in the centre is surmounted by a vast dome and gilt crescent.

In Plate *Castle*, C. 71, *fig.* 1, is shown the dome, minarets, and style of architecture, of the mosque of the college of Ispahan. Fig. 3. is a sketch from one of the streets of Ispahan, showing the general appearance of the Persian houses. Fig. 2. is the fire altars of the *Sang-i-Sulieman*.

Amongst the buildings of the eastern countries, not the least conspicuous are the caravanserais, or public edifices for the reception of strangers. Many fine buildings of this kind are found in Persia. They are generally of a square form, with porticoes surrounding a court; the former to shelter the horses and camels, with rooms for the travellers, and warehouses for the merchandise, &c. These buildings are in some instances formed on more ancient edifices. The *Caravanserai-i-Doob*, is thus described by Ouseley: "It is a spacious chamber, hollowed with admirable ingenuity, and by means of prodigious labour, into the very heart of the mountain. Its roof seems formed of arches, supported on square pillars, of large, but not ungraceful proportions; the roof, however, the pillars, the arches, and the walls, are all of the solid rock. It receives a little light at the entrance, an ample and handsome doorway in the side of the mountain, and from a square aperture in the centre of the roof, where the rock is ten or eleven feet thick. The chamber itself is a square of seventy feet, regularly divided into four parts by the rows of pillars intersecting one another. Near the door were inscriptions carved in the Arabic character, not very ancient (about A. D. 1305, or 1350.) In the wall terminating the main aisles on the left and right, and opposite the door, were niches not unlike the fire-places in European houses, and sculptured with some degree of elegance." To the right is another small square elevation. The inscriptions and pointed doorways are in the modern Saracenic style, but the excavation, he thinks, can scarcely have been the work of Mussulmans, or have been originally designed for the purpose which its modern name indicates. It may have been a place consecrated to Mithratic rites, as other caverns in the neighbourhood are of undoubted antiquity.

Perspective, (Lat.) is defined as the science which teaches us to dispose the lines and shades of a picture, so as to represent, on a plane, the image of objects exactly as they appear in nature. Perspective in its widest sense embraces three subjects: *lines*, which determine the outline; the *clair-obscure*, which shows the relief; and the *colour*, which gives the true appearance. The *lines*, from what we call the design, and the *colouring* in conjunction with the design, constitute the art of painting; consequently, we may divide perspective into *linear* and *aerial*. *Linear perspective*, is a branch of the mathematics, and as such is subject to principles that are rigorously demonstrated: it shows how the lines which define figures appear to the eye of the spectator, according to the point on which the eye is fixed, and the distance of the objects. *Aerial perspective*, is so named, because it is the effect of the vaporous air, which is interposed between the different objects: this air diminishes by its colour the tones, in proportion to the greater or less quantity and distance of the plans of the picture, in relation to the eye.

Perspective is generally divided into *projection*, *ichnography*, *orthography*, *scenography*, and *stereography*. The first delineates objects in a plane by means of right lines, called rays, supposed to be drawn from every angle of the object to particular points. *Ichnography*, or *ichnographic projection*, is described by right lines parallel among themselves, and perpendicular to the horizon from every angle of every object, on a plane which is parallel to the horizon, the points where the perpendicular lines cut, that plane being joined by right lines. *Orthography*, represents the vertical position and appearance of an object, exhibiting either the front or elevation, or the side or profile. *Scenography*, shows us how to direct the visual rays to every point or part of a picture, and *stereography*, enables us to represent solids on a plane, from geometrical projection.

The definitions of perspective will be best understood by the figure, (*fig*. 4. *Chinese Architecture*, C. 29,) where we must imagine the plane ABC to represent the plane of the picture, O the point of sight, the plane ODE the directing plane, F and G original points, FG an original line, and FGH an original plane; let the original line GF meet the picture in BI and the directing plane in DE, BI is the intersecting line, B is the intersecting point, and D the directing point. Again, let OAG be a plane parallel to the original plane; FGH meeting the picture in the line AC; AC is the vanishing line of the plane FGH. If the line OV be parallel to the original line FG, and meet the picture in V; V is the vanishing point of the line FG. Let FG be produced and meet the picture in B, and the directing plane in D; B is the intersecting point of the line FG, D its directing point, and OD the director. If OS be perpendicular to AC, meeting it in S, S is the centre of the vanishing line AC.

The question has often been discussed, whether the ancients really knew and observed the rules of perspective, in the practice of the arts. That they knew it, none can deny. Euclid has left a distinct treatise on it, and Vitruvius tells us that Agatharchus, the disciple of Æschylus, was the first who wrote upon this subject; and that subsequently the principles of the art were more clearly elucidated by his followers Democritus and Anaxagoras. Of the nature of their descriptions we are in total ignorance, but what Euclid, so distinguished as a mathematician, has written on the subject, shows us evidently that they had not made great progress in it; and the remains that have come down to us of the works of the ancient painters, &c. are not calculated to make us think that they thought proper to conform to the little that was known. That the Arabians were not ignorant of perspective, appears from the optical writings of Al Hazen, who flourished about 1100; his work is cited by Roger Bacon, who himself treated the subject very accurately, if we consider the age in which he wrote. M. Fiorillo, in his Kliene Schriften, (8vo. 1803,) has traced the history of perspective amongst the ancients, and since its revival amongst the moderns. Johannes Tzetzes, in the twelfth century, speaks of perspective as though he were well acquainted with its importance in painting: and the Greek painters, who were employed by the Venetians and Florentines in the thirteenth century, seem to have brought some knowledge of its principles with them, for the disciples of Giotto are commended for observing perspective more regularly than any of their predecessors in the art had done, and they lived in the beginning of the fourteenth. Danti, in his work "Sopra la prima regola del Vignola," p. 82, says that Pedro del Borgo was the first who published the true rules of perspective, and that he left in manuscript three books on the science, which, he adds, were copied in great part by Daniel Barbaro. Pedro is said to have died in 1443. In 1440, Bartolemeo Bramantino, of Milan, published his book, "Regole di Prospettiva, e misure delle Antichitá di Lombardia." Balthazar Peruzzi, of Sienna, who had studied diligently the writings of Borgo, discovered the points of distance to which every line that makes an angle of 45° with the ground line is drawn. Soon after, Guido Ubaldi discovered that all the lines parallel to each other, if they be inclined to the ground line, converge to some point in the horizontal line, and that a line drawn from the eye parallel to them will also pass through this point. Ubaldi's work on perspective was printed at Pesaro in 1600, and may be said to contain the first principles of the method afterwards established by Dr. Brook Taylor.

The following are the principal of the numerous works published on Perspective. In *Latin*—Johannis Cantuariensis, Perspectiva, fol. Pisa, 1508; an Italian version of which was published by Galucci, fol. Venice, 1593.—C. Vittelionis, de Natura, Ratione, et Projectione Radiorum Visus, Luminum, Colorum, atque Formarum, quam vulgo, Perspectivam vocant; libri x. fol. Norimb. 1551.—Joa. Fr. Niceroni, Taumaturgus Opticus studiosissimus Perspectivæ, fol. Paris, 1638: a French translation of which was published under the title of Perspective Curieuse, fol. Paris, 1663. —Guido Ubaldus, Perspectiva, fol. 1600.—Em. Maignan, Perspectiva Horaria, Rom. 1648.—Andrea Putei (surnamed Pozzi,) Perspectiva Pictorum et Architectorum, two vols. folio, Rome, 1693, 1700, with two hundred and twenty-six engravings: this edition was in Latin and Italian, and it was published in Latin and German by J. Boxbarth and G. C. Bodenner, fol. Augsburg, 1706-9; an edition was likewise published in Latin and English by Strutt, fol. London, 1693-1707.—Ram. Rampinelli, Lectiones Opticæ, Brix. 4to. 1760. Lamy's book appeared in 1701, and S.Gravesandis in 1711, both in 8vo: the latter was translated into English by Stone, in 1724. De Breuil, Perspectiva Practica, is also worthy of notice.—In *Italian*—Bern. Zenale da Trefigi, Tratteto di Prospettiva, fol. Milan, 1524.—Barbaro, Pratica della Prospettiva, Venice, fol. 1559, 1568, 1669.—Dispareri in Materia d'Architettura e di Prospettiva, 4to. Bresc. 1572.—Vignola, le due Regole della Prospettiva prattica, con i comment. del P. E. Danti, fol. Rom. 1583, 1611, 1644.—Bol. 1682, Ven. 1743.—Serigati la Prattica di Prospettiva, fol. Ven. 1596, 1626.—Accolto, Discorso, interno al Disegno con gl' Inganni del Occhio, Prospett. Prat. fol. Firenza, 1625.—Contino, Prospettiva Prattica, fol. Ven. 1645, 1684.—Giul. Troili, Paradossi per praticar la Prospettiva, senza saperla, fol. Bol. 1672, 1683.—Paolo Amato, Nuovo Prattica di Prospettiva, fol. Pal. 1736.—Zanotti, Trattato Teoretico Prattico di Prospettiva, 4to. Bol. 1766.—Orsini, della Geometrie e Prospettiva Prattica, 3 vols, 12mo. Rome, 1774.—In *Dutch* we have Het Perspectiv Conste van J. F. Vredemann, fol. Lond. 1559. Amst. 1633, a French translation of which was published by Marolois, fol. Amst. 1662 —Onderwysinge in der Perspectiv Conste, door Hen. Hondius, La Hague, fol. 1622, 1647, a translation of which appeared in 1647. —In *German*, treatises on Perspective have been published; of perspective as it regards the Arts, fol. 1509.—by Rivius, fol. Nuremb. 1547; by Lantensak, fol. Franc. 1567; by Jamitzer, fol. Nur. 1564; by Bruns, Leips, fol. 1615; by Lenkart, fol. Augs. 1616; by Alberti, fol. Nürnb, 1623-7; Schabler, 2 vol. fol. Nürnb. 1719-20; Heinecken, fol. Augs. 1727, 1753; Bischof, 8vo. Halle, 1741; Lambert, 8vo. Zurich, 1759, 1774; Werner, 8vo. Erfort, 1764: Jacobz 8vo. Amst. 1767; Voch, 8vo. Augs. 1780; Burja, 8vo. Berlin, 1793.—In *French* the following authors have written on perspective: Cousin, fol. Par. 1560, 1587; Cerceau, fol. Par. 1576; Caux, fol. Lond. 1612; Josse, fol. Par. 1635; La Perspective Pratique, &c. par un de le Com. de Jésus, 4to.

Par. 1642, 1663, 1679. English translations by Prike, 4to, 1672, by Chambers, fol. 1726. German by Rembold, 4to Augs. 1710; Bossa, 1648, a very extensive and useful work; Huret, fol. Par. 1675; Lami, 12mo. Par. 1701, 8vo. Amst. 1734. English translation. London, 1702; Bretetz, fol. Par. 1706, 1746, 1752; Courtonne, fol. Par. 1710, 1725; Ozanam, 8vo. Par. 1711; Jeaurat, 4to. Par. 1750; Le Roy, 12mo. Par. 1757; Petitot, fol. Parma, 1758; Curel, 8vo. Stras. 1766; Michel, 8vo. Par. 1771; Morien, 8vo. Par. 1789; Valenciennes, 4to. Par.—The principal works in *English* are, Mason, Practical Perspective, fol. 1670; Halfpenny, 4to. 1731; Peake, Architectural Perspective, fol.; Hamilton, Stereography, fol. 1738, 1749; Ditton, fol. 1712; Brook Taylor, 1715, 1719; Oakley, fol. 1730; Kirby, 4to. 1755, 1768; Perspective of Architecture, on the Principles of Brook Taylor, 2 vols. fol. 1755, 1761; Ferguson, 8vo. 1755, 1778; Highmore, 4to. 1784; Cowley, 2 vols. 4to. 1766; Priestley, 8vo. 1770; Noble, 8vo. 1771; Malton, fol. 1776; Ware's Complete Body of Architecture, folio, 1760; a new Treatise on Perspective, 4to. 1810; Cresswell, 8vo. 1811; Milne, in his Elements of Architecture, 4to. 1812; Hayter, 8vo. 1812; Martin, Muller, and Emerson, in their courses of Mathematics; Nicholson, in his Architectural Dictionary, &c.

Perticæ, beams in the ancient churches, behind and about the altar, ornamented at the great feasts with reliquaries of ivory, silver, &c.

Peruzzi, *Baldassare*, an Italian artist, born in 1481, at Accajano, in the territory of Sienna, in mean circumstances: his father had been reduced by the civil wars, in the territory of Florence, from a state of comparative affluence. Young Peruzzi began to exhibit his abilities in painting at an early age, and he was afterwards employed by pope Alexander VI. He also studied architecture, and was so noted for his knowledge of perspective, that the works he produced in imitation of architectural projections, excited the admiration of Titian. But he was chiefly renowned for his paintings in fresco and oil. He died by poison, in 1536, and left in manuscript a treatise on the Antiquities of Rome, and a Commentary on Vitruvius.

Pest House, a lazaretto.

Peter *of Colechurch*, an English priest and architect, who built the old London bridge, in the reigns of Henry II., Richard I., and John.

Peter's, *St.* the principal church of Rome, founded originally by Constantine the Great, over the reputed grave of St. Peter, on the Vatican hill, on the site of the circus of Caïus, or Nero. It is also called the *Basilica Vaticana.* It has since sustained a great number of alterations and repairs, and now surpasses all the most celebrated buildings, ancient or modern, in its size, and in the beauty of its structure. The portico is ornamented with statues of the first popes, who suffered martyrdom, the work of Algardi, surrounded by angels, festoons, gilt stucco, &c. The marble columns are of surprising magnitude. The entrance is by five doors; that in the middle, of metal, the work of Filareto, of Constantinople, in the time of pope Eugenius IV. sculptured with the martyrdom of St. Peter and St. Paul, and some events of the life of the pope at whose order it was made. The *porta santa* (holy door) the fifth, is only opened in the jubilee year:

under the portico, near it, is inscribed on marble, the first papal bull for the jubilee, the work of Boniface VIII. The splendour of the interior is minute: it does not consist in a grand *ensemble*, but in the extraordinary magnificence of every part. The sculptures are of gigantic proportions, and have in general a grand effect. The marble doves with olive branches, appear at first as if they might be touched with the hand, but on a nearer approach they prove to be very high, and appear as though they were flying higher every step you approach. To the middle aisle there is a magnificent marble pavement, and its ceiling is ornamented with gilt stucco worked in grotesque. The altar, called the *confessional of the apostles*, is situated in the centre of the cross aisle, under the grand cupola: under it are said to be laid half the body of St. Peter, and half that of St. Paul. This was the site of the ancient Vatican cemetery. The shrine has over it a canopy, that was erected by pope Urban VIII. at an expense of 100,000 crowns for the workmanship alone.

The grand cupola is said by some to equal, and by many to exceed, that of the Pantheon. The ball is twelve palms in diameter, and the cross, cast in bronze, is twenty-five feet high. The inside is covered with mosaic work. If we compare the cupola of St. Peter's, with that of St. Paul's, in London, it will appear, that, though the one is decidedly an imitation of the former, there is a material difference in the decorations. The buttresses of the dome tower in St. Peter's, though each decorated with two engaged columns and pilasters, by projecting from the cylindric wall, have a disagreeable effect. The dome is pierced with three rays of little dormer windows, which add little to the effect of the exterior, and only serve to light the interior staircases. The following is a comparative scale of the dimensions of St. Paul's at London, and St. Peter's at Rome, in English feet.

HEIGHT.	St. Paul's	St. Peter's
From the ground to the top of the cross	370	437½
The turrets as they are at St. Paul's, and were at St. Peter's	222	280½
To top of statues in front	135	175
First columns (Corinthian)	33	74
Their bases and pedestals	13	19
Capitals	5	10
Diameter	4	9
Composite pillars at St. Paul's, and Tuscan at St. Peter's	23	25½
Triangle of mezzo-relievo, with its cornice	18	22½
Bases of the cupola to the pedestals of the pillars	38	36½
Pillars of the cupola	28	32
Pedestals and bases	5	4
Capitals, architrave, frieze, and cornice	12	12
Cornice to outward slope of cupola	40	25½
Lantern	50	63
Diameter of ball	6	9
Cross	6	14
Outward slope of cupola	50	89
Cupola and lantern from cornice to top of cross	240	280
Height of niches in front	14	20
First windows	14	20
LENGTH.		
Whole length of church and porch	500	729
Porch within	50	218
Square by the cupola		328
From the door within to the cupola	190	313
From cupola to end of tribune	170	167
BREADTH.		
Church, within the doors of the porticos	250	510
Front with the turrets	180	364
without the turrets	110	318
Church and their naves	130	255
Church and widest chapels	180	364
Porch within	20	40
Nave at the door	40	67
At the third pillar and tribuna	40	73
Side aisles	17	29
Outward diameter of the cupola	145	189
Inward diameter	100	138
Square by cupola		43
Turrets	35	77
Outward diameter of the lantern	18	36

Pevensey Castle, in Sussex, from the quantity of Roman bricks employed in it, is believed to have been constructed out of the ruins of some Roman fortress. The external walls enclose an area of seven acres. The towers are tolerably high, to the height of twenty to twenty-five feet. The principal entrance is from the west, between two round towers, in which are considerable layers of Roman brick, about twenty feet from the ground, and four or five asunder. There are no Roman bricks in the interior works, and they are only found in the north and west sides of the outer. It is related, that in 1710, a workman having to make his way under the wall in the moat, discovered the foundation to consist of piles, planked over with slabs of an extraordinary substance, which appeared to be not in the least decayed.

Phalangæ, (Gr.) or *Scutulæ*, a name given, by Vitruvius, to a kind of wooden rollers, which were used to transport heavy burdens from one place to another.

Pharos, (Gr. from *φως*, *light*, and *οραω*, *to see*,) amongst the ancients, a light-house. The name was first given to a celebrated light-house on an island opposite Alexandria in Egypt. It appears to have been a magnificent building, but the accounts of the ancients are evidently much exaggerated. The Rhodian colossus also served as a light-house. See *Light-house*, and *Eddystone*. The pharos of Alexandria is represented on many medals of that city, and on some we observe Isis, with the surname *Pharia*, entering the port in a ship with full sail. There were many of these buildings in Italy. Suetonius speaks of one in the isle of Capræa. Stephanus of Byzantium, mentions a celebrated pharos at the mouth of the river Chrysorrhoas, on the Thracian Bosphorus. A celebrated pharos was, in 1643, still in existence at Boulogne-sur-mer, *Bononia*, which was also known by the name of *Gessoriacum*. This is supposed to have been the same that is mentioned by Suetonius, in the life of Caligula, who built it. This tower was an octagon, and each side was, according to Bucherius, twenty-four or twenty-five feet. It had twelve galleries, one above the other, each worked in the thickness of the wall, about a foot and a half wide, thus diminishing by degrees towards the summit. It had been known for ages by the name of *turris ordans* or *turris ordensis*, and it was called by the people of Boulogne *tour d'ordre*, all which names are supposed to have been derived from *turris ardens*, or the burning tower, from the fire which was kept burning all night at the top. A plate of this tower, from a design which was preserved at Boulogne, is given by Montfaucon, Supplém, à l'Antiq. expl. tom. iv. pl. 50, and he has given another of a similar construction on plate 51. On pl. 50, he has presented us with an engraving from a medal of Apamea, with the representation of a pharos upon it, and another from a medallion.

Pharillon, a little pharos.

Phatnomata, (*φατνωματα*,) the name given by the Greeks to arched or vaulted ceilings.

Pheasantry, a building for rearing pheasants in.

Phengites, (Gr.) a firm and brilliant marble discovered in Cappadocia, in the reign of Nero, and still found there. Specimens are also found in Germany and France, and in England, in Derbyshire and other counties. It was used among the ancients in the construction of windows; and it was employed in the construction of Nero's golden house, and of the temple of Fortune : this temple, which was entirely built of it, had no windows, and yet the interior was quite light when the doors were shut, owing to its transparency. Pliny says, that it was customary to construct beehives of this material, for the purpose of overlooking the work of the bees. Domitian had a portico, in which he was in the constant habit of promenading, enclosed with phengites, that he might be enabled to see every thing that was passing on without-side. Phengites bears the semblance, when dug up, of a rude irregular mass, very shattery and friable, but excelling most marbles in brightness, and far surpassing them in transparency. The colour is a pale straw colour, inclining to a rich white, the yellow tint more deeply marked in some places than others. "Stuart (speaking of the Erictheion) imagines that the windows were closed with transparent windows, or pheugites : that stone, however, seems not to have been known until the time of Nero. They were, perhaps, closed with *lapis specularis*, which, though a general term, is commonly supposed to signify talc, or mica. Glass might even have been employed, but this was not likely; for though in many parts of Greece I discovered fragments of glass vases, and several glass bottles, in the Athenian sepulchres, yet I never found any fragments perfectly flat, as the glass used in windows must be. It is said that a glass window, almost entire, was discovered many years ago amongst the ruins of Pompeii; and it would appear from Pliny, that it was used by the Greeks as well as the Romans; but probably not in early times." Mica, phengites, and horn were, according to the best evidence, (see Vopiscus, Seneca, and Tertullian,) the earliest sorts of glazing. The invention of glass mirrors is also of uncertain date. The representations of metallic mirrors are found in the most ancient female sepulchres, and are even mentioned in Exodus. They were of bronze or mixed metals; but *specula* of glass are first mentioned in a work attributed to Alexander Aphrodisius, who lived about the end of the second century. (Dodwell.)

Phials, or vases, used by the ancients in building vaults, to render them as strong as possible. The apertures were placed at the top, and within and around them they poured small stones and cement. Denon thus describes arches of this construction, which he found at Vianisi in Sicily. A sort of phials, eight inches long by three wide, without bottoms, and filled with mortar, having their necks introduced into each other, in a row, covered over again with a general coat of plaster, on which a brick was laid flat, then a fresh bed of mortar, and another brick upon this, like the former. It was scarcely possible ever to destroy semicircular arches fabricated in this manner, and it was with the utmost difficulty that he could wrench off a few fragments. According to Alberti, the phials were used to ease the weight, and they were made without bottoms, to hinder the possibility of water collecting in them, and thus rendering them heavy : and he says that the cement was very light, but extremely tenacious, "et cementa super infundere ex lapide minime gravi sed alioquin tenaci." (See Denon's Sicily, p. 317. Alberti, de re ædificatoriâ, f. xiv.)

Philo, a Grecian mentioned by Valerius Maximus and Cicero, as the architect of the Peiræau docks, and celebrated also for his eloquence. V. Max. viii. 12. Cic. de Orat. i. 14.

Phocicum, an edifice among the ancient Greeks, in which were held assemblies of the deputies from all the Phocæan towns. It was situated near the city of Daulis, in Phocis, and is described by Pausanias in the fifth chapter of his tenth book.

Phœnicians. The Phœnicians were one of the most polished and industrious nations of antiquity. Almost all the arts flourished among them, as is attested by the so much boasted magnificence of Tyre and Sidon. Solomon employed the Phœnician artists in the construction of the temple at Jerusalem. Strabo and Appian speak of the beauty and prodigious height of the houses of Tyre and Carthage. The temples were enriched with statues of gold. The grandeur of the city of Tyre is described in the twenty-seventh and twenty-eighth chapters of Ezekiel. The Phœnicians built several cities distinguished for their magnificence. Hiram, king of Tyre and Sidon, and the friend and ally of Solomon, is mentioned as the founder of many palaces and cities. Some have conjectured that the Phœnician architects constructed the principal part of their edifices with timber, as the mountains of Lebanus supplied them with it in great quantities, and its cedar is much celebrated.

Phryctorion, (Gr.) a tower among the Greeks, on which was placed a sentinel, who gave notice of the approach of an hostile force by means of fire. Thus in the Agamemnon of Æschylus, a sentinel watches from the top of the palace of that hero over the country in the direction towards Troy, and at length he perceives the fire on a tower, which announces the fall of the city. A machine of this name, for the same purpose, was used in ancient theatres.

Phrygian Marble, see *Marble*.

Phrygian Stone, a substance employed by the ancients in the process of dyeing.

Phygalia, a city of Arcadia, where are still found, among other ruins, fine remains of the temple of Apollo Epicurius, which was of the Doric order, has six columns in the fronts, and fifteen in the flanks. There was also a range of semicolumns, abutting against the lateral walls of the cella, and from their being in it some parallel with the columns of the peristyles. Many of the blocks of stone which formed the roof, are to be found within the limits of the cella, which are of sufficient breadth to extend from centre to centre of two adjoining columns. Ictinus was the architect of this temple, and it was considered as, next to the temple of Minerva at Tegea, the most beautiful in the Peloponnesus. The greater part of it still remains. Its length is one hundred and twenty-five feet, breadth forty eight feet, length of the cella fifty-three feet, breadth twenty feet, and length of the hypæthral or unroofed part of the cella thirty-five feet. The columns, including the capitals, are about twenty feet high. It stands in a position nearly north and south. The capitals resemble those of the Parthenon in form. The sculptures of the frieze are now preserved in the British Museum. The substance of which the temple is built, is a fine close-grained stone, or litharge, which is found in the vicinity: its colour a light brown, with a suffusion of yellow. (Dodwell, Stuart, Chandler.)

Piazza, (*Piache*, Ital.) a comtinued archway, or vaulting, supported by pillars; a portico.

PICKET, in fortification, a stake sharp at one end, to mark out the ground and angles of a fortification, where the engineer is laying down the plan of it, to hold together fascines or faggots in any work cast up in haste, and for several other purposes.

PICT'S HOUSE, or *Burgh's Castles*, a name given to some singular remains of the ancient inhabitants of North Britain, which are found frequent in the Scottish Islands. Sometimes they stand in little holms in the midst of lochs, with a road formed of stones to connect them with the island; sometimes on high land by the sea, near the brink of precipitous rocks, but much oftener on the skirts of sandy bays, and in the vicinity of landing places. They are to be found in the countries from which the Picts originally came. There is a remarkable one at Sualsburg, near Drontheim; and another called the Castle of Ymsburg, in Westrogothia. (Dalberg, Suecia Antiqua et Hod.) Many of them are still to be seen on the shores of Caithness, of Sunderland, and of East Ross, and the vale of Glenelg, near Bernera, contains four, (Pinkerton.) The foundations of several have been discovered on a plain near Perth; and that of Dornadilla, in Strathnaver, is no less distinguished for its structure, than the very large one at Dunrobin castle. But they are most frequent, and in the best preservation, in the northern isles. They are almost without exception of a circular base, rising in the shape of a cone, with its top somewhat blunted. Stones of a convenient form, and of a large size, without cement, are the materials of which they are constructed. They are of two kinds. The smaller, which seem to be the oldest, consist of one thick circular wall, in the inside of which there are sometimes places which might have served for beds. The larger kind is far more complicated in its internal structure. Besides the outer wall, which it has in common with the former, it has also an inner one, concentric with, and distant about two feet from the former. The walls sometimes meet at no great height. In others they ascend parallel to each other, at the distance of little more than two feet, and this space, which is entered by a door of two feet high from without, is occupied by a stair of a winding spiral form, from the bottom to the top of the building. The largest kind are surrounded by a broad deep ditch, and a sort of rampart. One of the finest that has been examined is at Quanterness, under the brow of the hill of Wideford, a little more than a mile west from the road or harbour of Kirkwall. Its external form is that of a truncated cone, in height about fourteen feet, in circumference at the base three hundred and eighty-four feet. It is probable that it was surrounded by two walls, but the quantity of rubbish rendered this circumstance difficult to ascertain. Internally it consists of several cells or apartments, the principal one of which is in the centre, built with large flat stones, without cement, the one immediately projecting over that below, so as gradually to contract the space within as the building rises, till the opposite walls meet at the top, when they are bound together by large stones laid across. Six other apartments, of a similar form and construction, but of little more than half the dimensions, communicate with the central one, each by a passage of about two feet square, on a level with the floor. There does not appear to have been any contrivance for the admission of light. The earth at the bottom of the cells, as deep as could be dug, was of a dark colour, of a greasy feel, and of a fetid odour, plentifully intermingled with bones, both of men, of birds, and of some domestic animals. In one of the apartments an entire human skeleton, in a prone attitude, was found; but in the others, the bones were not only separated from one another, but most of them divided into small fragments. From their appearance some have conjectured the inhabitants to have been cannibals. Fig. 7, (in Plate *Castle*, C. 65.) is a ground plan of this *Pict's House*, fig. 8 is an elevation of the principal room. The dimensions of the apartments are as follows. Largest apartment: length 21 feet 6 inches; breadth 6 : 6; height 11 : 6. Apartment No. 1.: l. 8:11; b. 3 : 6; h. 6:11; No. 2.: l. 7 : 2; b. 3 : 9; h. 8 : 7; No. 3.: l. 10 : 0; b. 4 : 1; h. 8 : 6; No. 4.: l. 9 : 9; b. 4 : 4; h. 8 : 1; No. 5.: l. 10 : 7; b. 4 : 1; h. 7 : 6; No. 6.: l. 9 : 5; b. 4 : 5; h. 7 : 0; Passage into the great room No. 7: l. 22 : 0; b. 1 : 9; h. 2 : 0. The passages from the great room to the small ones, were in breadth and height about the same as No. 7, and their length about 3 three feet 7 inches. (Barry's Orkney Islands; Pennant's Tour.)

Picts' Wall, see *Adrian's Wall*, and *Severus's Wall*.

Picturesque, "It is said of every object in general, which produces, or can produce, by a striking singularity, a fine effect in a picture." (Millin.) Perhaps the most correct definition that can be given of the picturesque in architecture would be, the agreement of the style of a building, with the situation in which it is placed. A cottage may be extremely picturesque; but a cottage by the side of a palace would have as ridiculous an effect, as a fine smooth building in a rustic situation. On this subject the reader may consult Gilpin's work, and the useful little book, Fosbrooke's Tourist's Grammar.

Piedouche, (Fr.) a little square base, smoothed and wrought with mouldings, which serves to support a bust or statue drawn half way, or any small figure in relief.

Piedroit, (Fr.) a square pier, partly hid in the wall, differing from a pilaster in having no regular base or capital.

Pier, (*pierre*, a stone, Fr.) a mass of stone, &c. opposed to the force of the sea, or of a great river, or supporting a heavy vault, the arches of a bridge, &c. See *Caisson*.

Pierres levees, and *Pierres debout*, (Fr. *horizontal* and *upright stones*,) the name given in France to the cromlechs, circles, and other monuments of the ancient Druids which are found in various parts, particularly in Poitou and Bretagne. The *pierres debout* are the upright stones, and the transverse stone the *pierre levée*. Caylus, in the fourth and sixth volumes of his Recueil d'Antiquités, has given engravings of several of these antiquities. The *pierre levée* of the Trébauchére, in the department of La Vendée, is one of the largest that has been described. M. Mazet, of Poitiers, measured it in 1785, when it was twenty-five feet long, seventeen broad, and more than two thick. It is supported by nine *pierres debout*, each about six feet high, forming a grotto twenty-four feet long by sixteen. From excavations made by the learned Bedictine Dom Fonteneau, and by M. Mazet, under many of these stones, they appear very commonly to have been places of sepulture. In Poitou there are *pierres debout*, which rise perpendicularly from nine to twenty-six and twenty-seven feet.

There are found Druidical monuments at no great distance from Montmorillon; one described by Millin, (tom. iv. p. 730) consists of a horizontal stone, more inclined to oval than square, eighteen feet long, fourteen wide, and three thick. It had four supports, but only one remains at present in its upright position.

The most remarkable monument of this kind is found near the little town of Carnac, three leagues from the town of Auray, in the department of Morbihan. It is described by De Cambry in his "Monumens Celtiques." The road from Auray to Carnac is extremely difficult; it is traversed by hills and cross roads, which are almost impassable. There cannot be a wilder or more deserted district. Some long stones, placed on the hills and on the hillocks of sand, precede the great theatre of which you are in quest. On the left and afar off we saw in the horizon heaps of stones, which we avoided, taking them for parts of walls or some ruined fortress: we reached at length one of the bounds of the monument towards the west. I will not attempt to describe to you my surprise at the sight of these wonderful masses stretching towards the horizon, in the midst of the desert which surrounds them; of this monument, so simple and majestic, so prodigious from its extent, and the labour it must have cost." These stones are placed in eleven straight lines, which are from thirty to thirty-three feet distant; and M. de Cambry supposes them to have been erected for astronomical purposes. "I have measured," he says, "the largest stones at Carnac. The most elevated are twenty-one or twenty-two feet above the ground. Their breadth and thickness vary as well as their height, but some of them are enormous, especially in that part near Kervario, near the mill of Kerner. One of them is twenty-two feet high, twelve broad, and six thick, exclusive of what is concealed by the sand; it must weigh 256,800 lbs., supposing the cubic foot of granite at 200lbs." They are all of this material. There are now about 4,000, and a great number have been destroyed. They are also described by Caylus, in the sixth volume of his Antiquités. M. Boulay, an enlightened inhabitant of Auray, told Cambry that they extended formerly nearly three leagues along the coast. Several views of this monument are given in "the Celtic Druids," by Godfrey Higgins, which are copied from Cambry's work. A description of the monument of Carnac is also given in the Archæologia, volume xxii.

Pilæ, square blocks placed upon the ancient epistylia, immediately over the columns, for supporting the timbers of the roof. The term was also given to buttresses built against the walls of a mole.

Pilaster, (Fr.) a kind of square column, which has its proportions and ornaments, such as flutings, &c. like those of the columns of the order from which it is named. It is generally engaged in the wall, having a projection of the third, fourth, fifth, or even only the sixth of its breadth. The pilaster must not be regarded as an imitation of the columns; it owes its origin to the necessity of giving more solidity to the walls of the cella of temples, where it was first used under the name of *antæ*. These antæ or pilasters served to strengthen the corners of the cella and the projecting walls of the pronaos. To give them more elegance, and to serve at the same time for ornament to the walls of the cella, they gave them a base and capital. In Doric temples, the pilasters as well as the columns were generally without base: this was not, however, always the case, as we see in the temple of Minerva Sunias. In Ionic and Corinthian temples, the pilasters had always a base and capital; both, however, differing from the bases and capitals of the columns of the same temple. These pilaster bases consisted of several members, sometimes plain, and at others ornamented with leaves, &c. In Ionic temples, the capitals of the pilasters were sometimes richly charged with ornaments which bore a great resemblance to what we denominate *Arabesque*. In the ruins of the temple of Apollo Didymæus, near Miletus, we find these capitals adorned with flowers and leaves elegantly interlaced, and others where genii are seen rising among the foliage. The capitals of the pilasters of the portico at Pæstum have a different form. Their profile consists of a line which reaches to the abacus, where it forms a kind of volute. Vitruvius says expressly, that pilasters ought to be the same breadth as the columns with which they range, and that they ought not to be diminished; and amongst all the monuments of Grecian architecture, the portico of Pæstum is the only one which offers us an example of pilasters with any diminution. It was not till a much later period, perhaps among the Romans only, that pilasters were made to bear the same capitals, bases, and ornaments, as the columns behind which they stood. The Pantheon, the temple of Antoninus and Faustina, that of Mars, the basilica of Antoninus, and other edifices at Rome, afford examples. In the age of Augustus, the pilasters were sometimes almost entirely detached from the wall against which they were placed, an example of which may be seen in the portico of Octavia: and about the same period began the practice of using pilasters without any columns before them; of this the Pantheon furnishes us with an example. The pilasters of these edifices have, however, no diminution. The triumphal arch of Trajan, which bears at present the name of Constantine, exhibits pilasters diminished in the same proportion as the columns behind which they stand. This example, however, was rarely followed by the ancients. In modern times some few architects have given diminution to pilasters. Pilasters are distinguished by various names, according to their order, their figure, their ornaments, application, &c.

Pilaster, Demi, or *Membretto*, a pilaster supporting an arch.

Pilaster Masses, in Gothic architecture, rectangular pillars or portions of wall, with impost mouldings.

Pile, a stake or beam of timber, driven firmly into the ground, to form the foundation of buildings, piers of bridges, &c. In foundations they are only employed when the foundation is suspected of being unsound. Amsterdam, and some other cities which have been built in similar situations, are wholly built upon piles. They make the foundation solid, by reaching deep into the earth, to a firmer stratum than that of the surface. Piles are sometimes driven in rows, to form the faces of wharfs, banks of rivers, piers for the sea, &c. for which purpose they are sometimes driven in rather an inclined position. They are also used in the formation of coffer dams, as a temporary defence against the water, in laying the foundations of bridges, &c. (see *Coffer-dam.*) The breach in the banks of the Thames at Dagenham, was stopped by means of dove-tailed piles, or piles mortised into each other by a dove-tail joint. Piles are generally formed of squared timber, but for laying foundations, and in other cases, when they are to be driven quite into the ground, small trees may be used without squaring. The pointed end should be shod with iron to enter the ground, and the other end bound with a iron hoop, to prevent it from being split by the blows of the pile-driver. In forming a tank, or coffer-dam, *pile-planks* are generally used, which have grooves formed in their adjacent edges, to receive tongues or slips of wood, which make their joints quite tight.

The practice of laying foundations on piles was common among the ancients. Some authors imagine also, that they trace the use of the *caisson* in laying foundations in rivers, &c. in the ninth book of the Æneid, ver. 710 et seq., where Virgil speaks of the piles which bare the moles of the famous bridge of Baiæ, and in the twelfth chapter of the fifth book of Vitruvius.

In the early part of the eighth century, the monastery of Croyland, in Lincolnshire, was erected. This is described by the historian, Ingulphus, to have been a stone building, succeeding the wooden oratory of St. Guthlac; and as the marshy soil on which it was situated, made it necessary to form an artificial foundation, that was done by driving into the ground a vast number of oaken and ashen piles, and bringing from a distance, in boats, earth and sand to compose a solid surface. (Ingulphus, Hist. Croyland, in the Script. post Bedam.) This circumstance is mentioned, by a manuscript poem on the life of St. Guthlac, cited by Camden, and preserved in the British Musæum.

"Nunc exercet ibi se munificentia regis,
Et magnum templum magno molimine condit,
At cum tam mollis, tam labrica, tam male constans
Fundamenta palus non ferret saxea, palos
Præcipit infigi quercino robore cæsos,
Leucarumque novem spatiorate fertur arena;
Inque solum mutatur humus, suffultaque tali
Cella basi multo stat consummata labore."

Pile Engine, or *Pile-driver*, a machine invented by M.Vauloue, to drive in the piles for the foundations of Westminster Bridge. A great improvement has been made in it by Mr. S. Bunce.

Pile Planks, have their ends sharpened to drive into the ground, and form a dam in a canal, &c.

Pillage, a word sometimes used for a square pillar, with a round base and capital standing behind a column, to bear up the arches.

Pillar, (*pilar*, Span. *pilier*, Fr.) an irregular, and rude column. The supporters in Saxon, Norman, and Gothic architecture are pillars, not columns. The form and dimensions of pillars are guided by no rules: they have generally a kind of foot or base, and a sort of cornice above; but are sometimes without either. Amongst the people of remote antiquity, particularly those of the north and west, large pillars, or rough single, often pyramidal stones were erected as memorials, as sepulchres, sometimes for religious purposes, and many of them were objects of worship: after the introduction of Christianity, this reverence was transferred to crosses, erected in various places, and the ancient pillars of their pagan ancestors were often adorned with the addition of the same symbol. These monuments, perhaps, bear affinity to the Egyptian obelisks, and had probably the same origin. They are supposed to have had at first some symbolical analogy with the Indian *lingham*. At the earl of Pembroke's mansion at Wilton, near Salisbury, is preserved a pillar formed of one piece of white Egyptian granite, nearly fourteen feet high, and twenty-two inches in diameter. It was brought from the temple of *Venus Genetrix* at Rome, and bears an inscription to *Astarte*. In common language, the terms *pillar* and *column* are often used as synonymous.

PINACOTHECA, (Gr. from *πιναξ*, *a picture*, and *θηκη*, *a repository*,) amongst the Romans and Greeks, a picture gallery.

PINE, (*πινος*, Gr.) This tree was well known to the ancients. Its leaves were employed by the Greeks to decorate their Pans, Bacchanals, &c. The species called *pinus cedrus*, or cedar, was much used in buildings. See *Cedar*.

PINION, in mechanics, a lesser wheel which plays in the teeth of a larger.

PINNACLE, (from the Lat.) the top or roof of a house terminating in a point, most frequently used in Gothic architecture. Amongst the ancients it was almost entirely confined to temples. Pinnacles with vanes mark the fifteenth century.

PINNING, fastening tiles together with oak pegs.

PIRÆUS, see *Port*.

PISA, a city of Etruria, of considerable antiquity, and some celebrity in the arts. One of its churches, called *Santa Maria della Spina*, from the report that among its relics are preserved part of our Saviour's crown of thorns, is a very singular edifice: it is situated on the banks of the Arno, is supposed to have been built about 1230, was repaired in 1300, and is a square low building, of rather a whimsical and grotesque appearance, being of that style of architecture, which is named in Italy *Gotico-Moresco*, which was introduced in the eleventh century, apparently from the East. The other kind of Gothic, the *Gotico-Tedesco*, or German Gothic, which is by some supposed to be an improvement of the former, is exhibited in the cathedral of Pisa, which, with the edifices pertaining to it, the baptistry, belfry, and cemetery, is perhaps one of the finest piles of buildings of the kind in the world. Its erection dates in the eleventh century. Its *campanile*, or belfry, is better known as the *leaning tower of Pisa*, (consisting of eight stories, divided by cornices, and each surrounded by pillars and arches,) and which inclines fourteen feet from the perpendicular in an elevation of one hundred and eighty feet. There are several other magnificent churches at Pisa, besides the cathedral. The remains of an ancient aqueduct is found in the vicinity, and a modern one, supported by one thousand arches, is carried to Leghorn. See *Campanile*.

PISAY, see *Pisé*.

PISCINA, among the Romans, was, (1) a fish-pond, (2) a shallow reservoir for persons to bathe in who did not know how to swim, or (3) a place for watering horses and washing clothes. In ecclesiastical architecture, the piscina was a bowl for water, generally in a niche in the wall of the church, in which the priest laved his hands. Piscinæ, or remains of them, may be found in almost all our ancient churches, as there was generally one attached to every altar. Properly speaking, it was a basin or sink, in which the priest washed his hands while performing the sacred rites at the altar, in allusion to the text, "I will wash my hands in innocency," (Ps. xxvi. 6.) and where all consecrated waste, or impure water, &c. that could be so disposed of, was emptied out. There is a great variety in their form, and some were as remarkable for plainness and simplicity as others were for their tasteful elegance of design, and richness of sculptural execution. The latter kind are found chiefly in buildings of the Gothic style. Fig. 12, Pl. *Castle*, C. 71, is a Piscina from Trinity church, Coventry. In Pl. *Carpentry*, C. 44, is given a figure of a Piscina at St. Alban's. Piscinæ were sometimes doubled.

PISE, or *Pisay*, (Fr.) a very useful and economical kind of building, which has been long practised in the district of Lyons, in France. It was known and practised at a very early period of antiquity, as appears from a passage in Pliny's Natural History, (lib. xxxiv. c. 14,) which is an exact description of this manner of building. M. Goiffon, who published a treatise on Pisé, in 1772, believes that the art was practised by the Romans, and thinks that by them it was introduced into France; and the Abbé Rozier, in his Journal de Physique, says that he discovered some traces of it in Catalonia; so that Spain, like France, has a single province in which this ancient mode of building has been preserved. We shall abridge the account of Mr. Francois Cointereaux, who published a work at Paris, in 1791, fully describing this mode of construction. Its value may be appreciated from his assertion of "the possibility of raising the walls of houses two or even three stories high, with earth only, which will sustain floors loaded with the heaviest weights, and of building the largest manufactories in this manner." It has been of late years introduced into England, and specimens may be seen at Woburn abbey, and some other places. Its durability is fully shown by the statement of the Rev. Mr. Jancour, who resided at Montbrison, where he says the church was a remarkable specimen of this kind of building: it is about eighty feet long, forty broad, and fifty high; the walls are built *en pisé*, eighteen inches thick, and *crépé* or rough-cast on the outside with lime and sand. Soon after his arrival, the church, by some accident, was burnt, and remained unroofed for about twelve months, exposed to rain and frost. As it was suspected that the walls had sustained much damage by the fire and the inclemency of the season, and might give way, it was determined to throw them down partially, and leave only the lower parts standing; but even this was not done without much difficulty, such was the firmness and hardness these walls had acquired: the church had stood above eighty years, and all the repairs it required, were only to give it, every twelve or fifteen years, a new coating of rough-cast on the outside.

The word *pisé*, or *en pisé*, is a technical term used first in the country, where this kind of building is in common practice. The manner of operation is merely by compressing earth in moulds or cases, that we may arrive at building houses of any size or height. All earths are fit for the purpose, when they have not the stiffness of clay, or the lightness of poor lands; all earths which are fit for vegetation; brick earth; and, more particularly, strong earths with a mixture of small gravel. The following are given as indications that the earth is fit for this purpose: (1) when a spade or plough brings up large lumps of earth at a time; (2) when arable land lies in clods or lumps; (3) when field-mice have made their abode in it; (4) when the roads of a village, having been worn away by the water continually running over and through them, are lower than the contiguous lands, and the sides of these roads support themselves almost upright; (5) when we find a difficulty in breaking the little clods of earth in the road with the finger; and (6) wherever deep ruts are observed in the road. In digging cellars and trenches for building, it most commonly happens that what comes out of them is fit for this purpose. When the earth that is near at hand is not of the proper kind, it may very often be rendered so by mixing. The principle of mixing it is very simple; strong earths must be mixed with light, those in which clay predominates with others that are composed more of sand, those of a rich glutinous substance with others poorer and more barren. The proportion of the mixture must be determined by the degree in which these different qualities prevail, and must be learnt by practice. With the earth may be mixed some small pebbles, gravel, rubbish of mortar, &c. but all animal or vegetable substances, or any thing liable to corruption, must be carefully excluded. Well-worked earth, in which there is a mixture of gravel, in about two years' time becomes so hard, that a chisel must be applied to break it, as though it were freestone. The following is one of the experiments recommended, to ascertain the goodness of the earth. Take a wooden tub without a bottom, dig a hole in the ground, fix a flat piece of stone level at the bottom, place the tub on it, and ram it tight all round with earth; then ram into the tub the earth you intend to try (which must be dug from a little below the surface of the ground, that it may not be too dry or too moist,) putting in at each time about the thickness of three or four fingers' breadths; ramming it well in, till it is filled up to the brim; make the earth at the surface of the tub perfectly smooth and even; then take up the tub from out of the ground, with the earth, or pisé, in it; turn the tub upside-down, and let the pisé out, or, if it should stick fast, let it dry in the air for twenty-four hours, when you will find it loose enough to drop out of itself; keep this lump of pisé exposed to the air, but sheltered from any rain that might chance to fall, and if it continue without cracking or crumbling, and increase daily in density and compactness, it is a certain proof that it is fit for building. If the earth be not well pressed round the outside of the tub while filling, the pressure of that which you are ramming in the inside will assuredly burst it, even though the hoops be of iron. The earth, as dug up for pisé, should be well raked with a rake of about an inch and a half between each tooth, so as to leave in it the small stones and pebbles, which are no larger than a wall-nut, as they will add to the strength of the mass. In mixing different kinds of earth, a portion of each should be thrown alternately on the heap, in the proportions found requisite, whilst another person mixes them together. No more earth should be prepared at once than is sufficient for one day's work, and if rain be expected, you must have at hand planks or mats to cover it with, the moment it begins; for the earth cannot be used when either too dry or too wet: if the latter, the workmen will be obliged to wait till it has gained its proper consistency; if the former, it may easily be moistened by sprinkling it with a little water; when wet in any considerable degree, the workmen had better stop the work.

The implements used in building *en pisé*, which are few and of very simple construction, are shown in Pl. *Tools*, fig. 4, *a* is the head of the mould seen withoutside; *b*, the other side seen withinside; *c*, *d*, the joists in which the upright post is secured by the wedges *e*, *e*: *f*, a round piece of wood called the *wall gauge*: *g*, one of the upright posts, with its tenon to enter the mortise in the joist. In our figure the parts are shown both separately and connected in their places for use.

To make good walls of pisé, the earth must not only be well beaten, but they must be well united together. In this mode of construction, in place of the angles or binders of freestone used in buildings, only a few thin pieces of wood are necessary, with a few cramps and nails, to give the greatest solidity. In one single day three courses, each about three feet high, may be raised one over another, forming a wall of about eight or nine feet; and it has been proved by experience, that as soon as the builders have raised their walls to a proper height for the flooring, the heaviest beams and rafters may be placed on the walls when newly made, and that the thickest timber of the roof may be placed on the gables the very instant they are completed. When the first course is laid on the front and inner walls, and before the second course is begun, the evenness and strength of the whole will be increased, by placing at the bottom of the mould a board about five or six inches long, and an inch thick, resting on the opposite angle, and so broad that there may remain on each side, four or five inches of the earth of the wall, which should be about eighteen inches thick; and the board, being concealed in the body of the pisé, will be out of the reach of the air or of damp, and of course there will be no danger of its decaying. The board should be rough from the saw. These boards need only be placed at the angles of exterior walls, and in those parts where the partition walls join it. It is also advisable, particularly where the earth is not of a very good quality, to put ends of planks into the pisé, after it has been rammed to about half the height of the mould: they should be only ten or eleven inches long, to leave, as before, a few inches of the earth of the wall on each side. Having determined the height of each story, boards three or four feet long should be placed beforehand in the pisé where the beams are to be fixed, and the beams may be laid on for each story, as soon as the mould is moved for the place, the pisé being continued as high as the place you intend for the roof. The openings for the doors and windows must be left, as you build the walls, by placing within the mould one or two of the heads of the mould, as may be required, where the opening is to commence. They should be made sloping a little, to leave room for the frames and sashes. The chimney pieces are laid in the same manner as in common building, and the flues are made of brickwork, and firmly connected with the walls. The apartments may be very handsomely finished without making any jambs to the inside doors, as the facings of wood to the earthen wall will render them unnecessary. In making very long walls, as for parks, &c. it will be found requisite to set several moulds to work at the same time in different places, for the sake of speed.

The rich traders of Lyons have no other way than this of building their country houses, and many are known to have lasted for upwards of a hundred and sixty years. An outside covering by painting in fresco, the way most commonly used, entirely conceals the nature of the building, and many of these edifices are extremely handsome. The plaster for the outside of pisé walls differs from that used on other walls, and it requires to be laid on at a proper time. When a house is begun in February, and completed in April, the covering may be laid on in autumn, that is, five or six months after it is finished; if finished in the beginning of November, it may be laid on in the ensuing spring. If it be laid on before the dampness of the wall is gone off, it will be liable to come off. To prepare the walls for plastering, they should be notched with the point of a hatchet or a hammer, the little dents thus made being very near each other. The wall should afterwards be run over with a stiff brush, to detach all loose particles. A scaffold may be quickly erected in the holes which the joists of the mould have left. Two kinds of plaster may be used—rough-cast, or stucco. The former consists of a small quantity of mortar, diluted with water in a tub, to which a trowel of pure lime is added, so as to make it about the thickness of cream. Stucco is only poor mortar, made in a clean place near the lime-pit, and carried to the masons on the scaffold. The rough-cast is laid on by first sprinkling the wall with a brush, and then dipping another brush, made of bits of reed, box, &c. into the rough-cast, which is thrown as equally as possible against the wall; as he lowers the scaffold, the workman can fill up the joist-holes with stones, or old plaster, &c. In stuccoing, one man sprinkles the wall with a brush, and lays on the stucco with a trowel, while another follows him, sprinkles water over the mortar thus laid, and smooths it with a wood flout. It may be whitened with lime as it is laid on.

Pit, (*cavea*, Lat.) the part of a theatre between the galleries and the stage.

Pitch, the vertical angle of a roof; the proportion between the height and span. When the length of the rafters is equal to the breadth of the building, it is denominated a *Gothic pitch*.

Pitching-Piece, a horizontal timber, with one of its ends wedged into the wall, at the top of a flight of steps, to support the upper end of the rough strings.

Pix, in the architecture of the middle ages, a box or shrine, sometimes called a tabernacle, and intended to contain the host, or consecrated wafer, suspended under the cibarium, or canopy of the altar.

Placard, the decorations of a chamber door.

Place, an open piece of ground surrounded with buildings, generally decorated with a statue, column, or some other ornament in the middle. Two terms were used by the Romans to designate a public place:—*area*, which meant a wide unappropriated space; and *forum*, which was a place destined for carrying on public business

Place, in geometry, is a certain extent wherein each point may indifferently serve for the solution of an indetermined problem, when it is to be resolved geometrically.

Simple place, is when the point that serves for the problem is found in a line, whether right or curved, and that by reason of the want of one condition only, to render the problem determinate altogether. *Solid place*, is when three conditions are wanting to the determination of the point sought, and so it will be found in a solid; and this may be included under either a plane, curve, or mixed superficies, and those either determinate or indefinitely extended. *Superficial place*, is when, there being two conditions wanting to determine any point that resolves any problem, that point may be taken throughout the extension of superficies, whether plane or curve.

Place of Arms, the body of a fortress. The *place of arms of a trench*, or *of an attack*, is a post near it, sheltered by a parapet, or epaulment.

Plafond, (Fr.) or *platfond*, the ceiling of a room; the bottom of the projection of the larmier of the corniche; a soffit.

Plain Tiles, or *Plane tiles*, tiles that have their surface planes.

Plan, (Fr.) the draught of a building, taken on the ground floor, showing the distribution, form, and extent, of its several rooms, passages, &c. In plans of buildings, the massive parts, as walls, &c. are generally distinguished by a dark shade. In a *geometrical plan*, the parts are represented in their natural proportions; a *perspective plan*, is exhibited with diminution, according to the rules of that science. The *raised plan* of a building is the elevation.

In ship-building, a plan is the section of a ship as designed upon paper, previously to the actual building, of which there are three principal ones, the plan of the elevation, (called *sheer-plan*,) the horizontal or half-breadth plan, and the plan of projection or body plan.

Plan *of a bastion*, the same as the *face of a bastion*.

Plancere, the under part of the roof of a corona, which is the superior part of the cornice, between two cymatia.

Plane, in geometry, a surface which coincides every where with a right line, which is every where perfectly true and level.

Plane, *Geometrical*, in perspective, a plane surface, parallel to the horizon, placed lower than the eye, wherein the visible objects are imagined without any alteration, except that they are sometimes reduced from a greater to a lesser size. A *horizontal plane*, is a plane parallel to the horizon, which passes through the eye, or has the eye supposed to be placed in it. A *vertical plane*, is a plane surface which passes along the principal ray, and consequently through the eye, and is perpendicular to the geometrical plane.

Plane, a carpenter's tool. Montfaucon has engraved an ancient carpenter's plane, nearly of the same form as the modern. The construction of the carpenter's plane is known to every one. The broad chisel, or steel cutter, is called the *plane iron;* it is fixed in a hole through the *plane stock*, projecting a very little beyond the *face of the plane*, which must be perfectly true. The *iron* is fixed by a *wedge*, which leaves an aperture before it called the *mouth* of the plane. There is a great variety of planes, known by their different names and uses. The first is the *jack plane*, which is generally about seventeen inches long, and is used for rough work, and for reducing the surface of large pieces of wood. The *iron* makes an angle of forty-five degrees with the face of the plane, and is a thin metal plate, one side iron, the other steel; the lower part is ground off the iron side to an acute angle, and the sloping part is termed the *basil;* the edge should be sharpened to a regular and slight curvature. A handle, fixed to the upper part of the stock, immediately behind the iron, is called the *tote.* A great improvement has been made of late years, by the introduction of the *double iron*, consisting of a second iron with a reversed basil, screwed against the front side of the iron, its edge lying against the iron at a very small distance from the cutting edge. Its use is to prevent the cutting-iron from splitting the shaving deeper than it will afterwards cut, and thus leaving an uneven surface. The *long plane*, is in length generally about twenty-six inches, and is set fine, and used for finishing work intended to be very straight. The *trying plane*, is of nearly the same length, and differs only from the *jack plane*, in having two handles. The *shooting plane* or *jointer*, is the most correct, as well as the longest plane in use, being generally about thirty inches long. The *smoothing plane*, is not above seven inches and a half long, has sides curved in the form of a coffin, and no handle, and is principally used for finishing work when put together. The foregoing planes are all denominated *bench planes*, as in their use the work is always laid on the work-bench. The *straight block*, is a plane used for straightening short edges. *Rebating planes*, are used for cutting out rebates or semi-grooves on the edge of a board, and sometimes for ornamenting mouldings, &c.; they are of different kinds, some having the cutting edge at the side, called *side rebating planes*, others on the face, and others again on both. *Fillisters*, are used for sinking or cutting away the edge of a piece of wood to form the rebate, the others smoothing it afterwards. The *moving fillister*, has a wooden ruler, named the *fence*, fixed by screws along its face, and covering part of the length of the cutting edge, and which may be moved so as to leave more or less of the cutting edge exposed, as the breadth of the rebate may require. In this plane the cutting edge has an obliquity of about forty-five degrees. An iron called a *tooth*, is placed so as to precede the other iron, and cut off the shaving from the side. The *sash fillister*, differs from the last in several particulars; the *fence* is not fixed by screws, but adapted for removal to a considerable distance, and fastened by two bars attached to it; the breadth of the iron is rather broader than the stock, so that the cutting edge projects a little at the side. Rebating planes are all about nine inches and a half long. The *plough*, is a very narrow plane, and has an apparatus to guide it in ploughing a groove at any required distance from the edge of a board. The *dado grooving plane*, is also used for making grooves. The *toothing plane*, is a fluted iron, with teeth in its edge, and is used in planing woods for veneering. There are other tools of this kind called *moulding planes*, which have curved faces and cutting edges, so as to form various ornamental mouldings; they are known by the names of *snipe's bills*, *side snipe's bills*, *beads*, *hollows*, and *rounds*, *ovolos*, *ogees*, &c.

Plane, *Inclined*, see *Inclined Plane.*

Plane Surface, a surface which lies evenly between its boundary lines.

PLANE TABLE, a rectangular board for finding the position and distance of points which are situated in the same plane.

PLANIMETRY, the part of geometry which treats only of lines and surfaces.

PLANING MACHINE, a machine for planing wood, which was intended to give greater expedition, with less trouble than by manual labour. The first machine of this kind was invented by General Bentham, in 1791, and consisted of a plane put in motion by means of a crank. Mr. Bramah invented a planing machine on an improved construction in 1802, which may be used for planing timber at a small expense. "The cutting tools," he says, in his description of it, "employed to reduce the wood, instead of being worked by hand, are to be fixed on frames, some of which are moved in a rotatory direction round an upright shaft, and others have a common shaft lying in a horizontal position, like a common lathe. In other instances, the tools are fixed on frames, which slide in stationed grooves, to be driven also by machinery." In 1803, Mr. Bevans obtained a patent for a machine for planing all kinds of mouldings, grooves, rebates, &c., the machinery of which consists in a crank, passing through a mortise in a box in which it slides, fixed on an axis, the motion of which is regulated by a fly-wheel. The planes are connected with a strong heavy beam.

PLANISPHERE, (Lat.) a projection of the sphere, and its several circles, on a plane.

PLANK, (Fr.) a name given generally to all timber, but fir, which is less than four inches thick, and thicker than a *board*, which is an inch and a half, and downwards.

PLANK SHEERS, or *covering boards*, planks which are placed horizontally over the heads of the timbers of the forecastle, quarter-deck, and round-house of a ship.

PLANTING, laying the first courses of stone on a foundation.

PLASTER, a composition of lime, with sand, &c. to cover the walls of a building. See *Mortar*, *Stucco*, and *Alabaster*.

PLASTER OF PARIS, a preparation of a species of gypsum or alabaster, dug near Montmartre, a village in the neighbourhood of Paris. It is calcined by fire into the fine plaster, which is so valuable for modelling, &c. When diluted with water to a thin paste, plaster of Paris quickly sets, and has its bulk increased at the instant of setting, and Mr. Boyle found, by experiment, that a glass vessel filled with this paste, and close stopped, bursts while the mixture sets, a quantity of water sometimes issuing through the cracks. Hence this substance becomes a valuable material for filling cavities, &c. when other earths would shrink. Two or three spoonfuls of burnt alabaster, mixed up with water to a thin substance, when thrown into a vessel full of water, quickly coagulate into a hard lump at the bottom.

PLASTER FLOORS, are exceedingly useful in cottages, &c. where they may be constructed at no great expense, and afford a great security against fire. The plaster must be composed of lime of a strong binding quality, and is laid on a kind of strong reed, or on laths nailed to the joists, which must be laid in the usual manner. These kinds of floors are in general use in Nottinghamshire and Rutlandshire.

PLATBAND, any square moulding with little projection; the fasciæ of an architrave; the list between flutings, &c. The *platband* of a door or window is the lintel, when it is made square, and not much arched.

Platform, a row of beams, which support the timber work of a roof, lying at the top of the wall; a terrace, or open walk at the top of a building.

Platte, *Plat*, or *Plot*, in old church architecture, a model or plan.

Plinth, (πλινθος, Gr. a *brick*,) the lower member of a base. Every body placed in an unright position ought to have its base or foot, and the part inferior to this is the plinth, by which the place of the former is often supplied. In a wall, the term *plinth* is applied to two or three rows of bricks which project from it, to any flat moulding in a front wall, to mark the floors, sustain the eaves, or the larmier of a chimney. See *Abacus*.

Plotting, the art of laying down on paper the angles and lines of a plot of land, by any instrument used in surveying.

Plotting Scale, see *Instruments*.

Plotting Table, an improvement by Mr. Beighton on the plane table.

Plug and Feather, or *Key and Feather*, a mode of dividing hard stones, by means of a long tapering wedge called the *key*, and wedge-shaped pieces of iron, called *feathers*, which are driven into holes previously drilled into the rock for the purpose, and thus forcibly split it.

Plugs, pieces of timber driven perpendicularly into a wall.

Plumbing, (from the Lat. *plumbus*, lead,) the art of casting and working in lead, and using it in building, principally in roofs, windows, pipes, &c.

Plummet, a weight of lead hung to a string, to sound depths or, on a level, to mark the perpendicular. See *Level*.

Pluteus, a term used by Vitruvius in different significations. In the description of the pronaos, and in that of the scene of the theatre, it means the walls between the columns, like what is observed in the flanks of the temple of Fortuna Virilis, and in the front of the temple of Saturn, described by Labacco. In the description of the basilica, he uses it to signify the continued pedestal, intervening between the upper and lower ranges of columns.

Plyers, in fortification, are a kind of balance, or timber levers, for raising or letting down a drawbridge.

Plymouth Marble, a very fine species, which is dug up in great abundance in various parts of Devonshire, particularly about Plymouth, from whence it is shipped to London. It is of a bluish white ground, varied with veins of pale red, with some of brown and yellow, and it is capable of receiving a good polish.

Pnyx, (Gr.) the spot where the citizens of Athens assembled to choose their magistrates. It appears from Plutarch, that the Pnyx was near the Museum. From a passage of Lucian, it appears evident that it faced the Areopagus. Harpocration says, it was within sight of the Propylæum. From Aristophanes we learn, that it was a place of assembly on a rock in the open air, with a stone *béma* or oratory, and near the city wall. Pollux says, it was constructed with ancient simplicity, not with the magnificence of a theatre. All these particulars join in proving it to be the ruins called by Stuart, the Odeum of Regilla. The Pnyx is said to have been first appropriated by Solon to assemblies of the citizens, but it is supposed by many, that it was the scene of popular convocations long atecedent to the time of the great Athenian legislator. The name Πνυξ is related to be derived from πυκα, dense, and Stephanus Byzantinus says, that it was so called from the density of habitations formerly built there, a fact which the indented rocks at present testify.

Podium, (Lat.) a continued pedestal; a projection from the wall which surrounded the arena of the ancient amphitheatre, and which formed a kind of gallery; it resembled a continued pedestal, in the plinth and kind of cornice with which it was ornamented on the side of the orchestra. In this gallery were placed the principal senators and magistrates sitting in their curule chairs; here also was the *suggestus* of the emperor, and the place allotted to the vestals, the priests, the ediles, &c. It was defended by a strong railing of iron bars, &c. from the wild beasts that were let loose in the arena; and Cæsar, farther to secure it, caused a canal called the *Euripus*, to be dug, and filled with water between the podium and the arena: see *Amphitheatre*.

During the middle ages, the word *podium* was employed to signify a place on the top of a mountain, particularly when the mountain was so steep on one of its sides near the place, that it could not be climbed. Many cities, towns, and villages of France, particularly on the side of Provence and Languedoc, where the Latin language was longer preserved, the name has remained. From this word *podium*, many have derived the word *puy*, which signifies the same thing, and was used in the same manner, as Le Puy-en Velay, *Podium*, Puy-Sainte-Marie, *Podium* Sanctæ Mariæ; Puy-Laurent, *Podium Laurentii*, &c.

Pœcile, or *Poikile*, (Gr.) The Poikile was the principal stoa or portico at Athens; it was adorned with a great variety of excellent paintings, and with shields taken by the Athenians from their enemies. It was first called the *pisianactic* portico, and received its name of Pœcile after it had been embellished with the paintings of Polynotus and Mycon.

Point, (Lat. *punctum*,) in Geometry, that which has neither length, breadth, nor thickness. An *accidental point*, in perspective, is a term used by the old writers for what is now called the *vanishing point*, which is in the horizontal line, and is found by drawing a straight line through the eye, parallel to an original line, which serves likewise for the vanishing point of all its parallels. A *conjugate point*, is that into which, in some curves, the conjugate oval vanishes. An *objective point*, in perspective, is a point on the geometrical plane, of which the situation on the perspective plane is required. The *point of distance*, is the distance of the picture transferred from the centre to the vanishing line. The *point of sight*, or *point of view*, the place of the eye whence the picture is viewed; the old writers gave this term to the centre of the picture. The *point of reflection*, in geometry, is synonymous with the *point of retrogradation*. The *point of contrary flexures*, is a point in a curve where it bends to a contrary part to that where it originally tended.

Pointed Style of architecture, a name given by some writers to the *Gothic*.

Polishing, see *Marble*.

Pola, an ancient city of Istria, of which numerous ruins still remain. Its amphitheatre has already been described under the article *Amphitheatre*. Of its two temples, one is dedicated to Rome and Augustus; it is of the Corinthian order, the intercolumniations of its prostyle being two diameters, except that in the centre, which is two and a half. The pediment is supported by four columns, forming, with two lateral ones, an open portico, which leads to the interior of the edifice. The bases of the columns have no plinths; the capitals are formed with olive leaves, and the volutes are invested with foliage of oak. The foliage round the circumference of the frieze is exquisitely sculptured, and the medallions and cornices are rich and delicate. The other temple, of which there are small remains, exactly resembled this in its ornaments and dimensions, the two porticoes being ranged in the same line. (See Allason's Picturesque Views of the Antiquities of Pola.)

Pole, (Gr.) a point ninety degrees distant from the plane of any circle, in a line perpendicular in its centre, which line is called the *axis*.

Polia, a beautiful species of stone, much employed by the ancients in building; called also *Amiantus* and *Corsoides*.

Pollard, a tree which has been frequently lopped or polled of its head and branches. It is a practice that does great injury to good timber.

Polygon, (Gr.) a geometrical figure of many sides. To find the area of a regular polygon, (1) multiply one of the sides of the polygon by the perpendicular from the centre upon that side, and multiply half the product by the number of sides; or (2) multiply the square of the given side of the polygon by the number opposite its name in the followng table, under the word *Area*. In this table the side of the polygon is one.

Table of Polygons.

Numb. of Sides.	Names of Polygons.	Area of Polygons.	Perpendiculars of Polygons.
3	Trigon	.433013	.2886751
4	Tetragon	1.000000	.5000000
5	Pentagon	1.720477	.6881910
6	Hexagon	2.598076	.8660254
7	Heptagon	3.633912	1.0382617
8	Octagon	4.828427	1.2071068
9	Enneagon	6.181824	1.3737387
10	Decagon	7.694209	1.5388418
11	Hendecagon	9.365640	1.7028437
12	Dodecagon	11.196152	1.8660254

Polygon, in fortification, an *exterior polygon*, is the distance of one point of a bastion from the point of another, reckoning all round the works: an *interior polygon*, is the distance between the centres of the bastions, reckoning round as before.

Polygram, (Gr.) a figure consisting of many lines.

Polyhedron, (Gr.) a solid contained under many sides. A *cylindric polyhedron*, is a solid, such that all sections made by planes perpendicular to a certain straight line within the solid, are similar and regular polygons; and that a plane passing along this straight line, may cut a side of each of these polygons perpendicularly, and the surface of the solid in the semicircumference of a circle, the diameter of which is the straight line. Hence, the surface of a cylindric polyhedron consists of as many cylindric surfaces as the horizontal polygons have sides; thus, when the horizontal sections are squares, it is a cylindric *tetrahedron*, when pentagons a *pentahedron*, when hexagons a *hexahedron*, &c. The lines where these surfaces meet are called the *edges* *of the solid.* The common diameter of all the semicircles is the *axis.* The semicircles are called the *right vertical sections*, while the regular polygons are called the *horizontal sections.* The *pole* of the segment of a cylindric polyhedron is that point which is common to the axis and the surface of the solid. A *segment* is a part cut off by a plane perpendicular to the axis. The *sectorial radius* of a segment, is the straight line perpendicular from the pole to one of the sides of the polygonal base. A *frustum*, is the portion of the solid contained between two horizontal polygons. The *apothem* of one of the polygons, is the radius of the inscribed circle. In plate *Dome* I, *fig.* 1, let ABCDEFGHA be a cylindric octahedron, $P' p'$ the poles, then the edges are $P' r i C$, $P s k \beta D$, $P' t l \gamma E$, $P' u m \delta F$, $P' v n \epsilon G$, &c. The horizontal sections are $\beta \gamma \delta \epsilon$, $i k l m n o$, $p q r s t u v w$, and one of the vertical right sections is $P' x y z$. This vertical section divides all the sides CD, $i k$, $r s$, of the horizontal sections into two equal parts. If this polyhedron be cut by the plane $p q r s t u v w$, and if $P' x$ be drawn, $P' x$ will be the sectorial radius, and if it be cut by the plane $i k l m n o$, then the sectorial radius will be $P' y$. *Fig.* 2, is a *hemicylindric* octahedron, or one of the segments, when the whole solid is cut into two equal segments; *fig.* 3, is a segment less than half: (4) a segment cut by a plane parallel to the base, or the greatest horizontal polygon; (5) an interior view of a segment; (6) a segment cut by a plane parallel to the base of the figure.

Polystyle, (Gr.) a building surrounded by so many columns, that we cannot readily calculate the number at a first view.

Pomœrium, (Lat.) a space near the walls of the city, amongst the Romans, which was considered as sacred, and not to be touched either by the plough or the builder, but had altars within its enclosure dedicated to the gods. Authors are not agreed as to its exact situation.

Pomel, (from *pomum*, Lat. an apple,) a globular protuberance terminating a pinnacle, &c.

Pompeii, a city of Campania, which was anciently a flourishing place, but it suffered the same fate as Herculaneum, and was buried under the lava and cinders of Vesuvius. It is about three miles distant from this mountain. At a mile from the *Torre dell' Annonziata*, we leave the road to Salerno, and turn to the right to arrive at the ruins of Pompeii. The first object that draws attention, is what is called the *country house*: it has been so called, because it is situated without the walls of the city, but it is not seen till we are close by it. The same is the case with the other edifices of Pompeii, which are all concealed behind the heaps of cinders which have been thrown up from the excavations that have made since its discovery. For the same reason an exact idea cannot readily be formed of the true extent of the city, and this difficulty is increased by the small elevation of the houses. This *country house* had two divisions, the one more elevated than the other. The columns, or rather square pillars, formed a covered gallery, which extended round the court, and round six other columns, which perhaps sustained a kind of portico. These columns, or square pillars, were covered with a yellowish stucco, and the pedestals were black, and adorned with arabesques. The second division of the building was decorated with several columns, which formed a rich portico, although of too diminutive proportions. In general every part of this country house was extremely close and narrow. On the road which passes before the entrance door, we still see the tracks of carriages. Near the door were found two skeletons; one of them held a key in one hand, and in the other a purse full of medals and precious stones. It is supposed that the other was carrying a box, full of different valuable things, which was found near it. Perhaps it was the master of the house and his slave, who, in flying, had carried with them their most valuable articles, but who, when arrived at the door, found it already encumbered beneath the cinders under which they were buried. The court of the house formed a square of ninety-four feet. The two corners of the side on which you enter, were occupied by two chambers, of which one probably served to lock up the corn, and the other to thresh it. In entering the court, an open portico was perceived, supported by six columns; on two sides it was surrounded by trees, of which the trunks and branches are still seen. Before this portico was a basin, the lead pipes of which were also found on the spot. At the extremity of the gallery was a stone vault, which appears to have served as a cellar, because there were found there many of those kinds of vases in which the ancients kept their wine: and they say even that in several of these vases was still found the remains of the wine, which was thickened, and had become by length of time as hard as stone. Near this is another stone cellar, very dark, and plastered with stucco; it has remained entirely uninjured, but was blocked up by the cinders. Near the staircase which conducts to this cellar were found seven skeletons of females, whom terror had doubtless driven at the moment of the volcanic eruption to seek shelter in this remote place, where they had perished. They had all pressed into a corner by the door, and when their bones were discovered, it was observed that the image and form was preserved in the cinders, where even portions of their clothing was preserved. These impressions are still shown in the Museum of Portici; and among other curiosities, the impression of the breast of one of these women, which is so well preserved, that we discover the impression of a very delicate lace: we also also see the form of the rings, bracelets, necklaces, and ear-rings, with which these ladies were adorned. Hamilton, in his account of the discoveries at Herculaneum, remarks on this circumstance, that the volcanic cinders, mixed with a great quantity of water during the eruption, formed a kind of clay, which would produce the same effect as the materials which are used in making casts. Near this cellar was a dark chamber, of which, as well as of five other small chambers which follow in succession, no one has been able to discover the use. None of them had windows. At the extremity of the gallery, we descend by a flight of steps to the second division of the house, which contains several apartments of different sizes, behind which was the garden, into which we descend also by a great staircase. In the whole of this part of the house, there has not been discovered as yet a single place which can be regarded as a bed chamber, except a kind of alcove and circular wardrobe, having three windows, which look into the garden. In the garden we still distinguish the compartments, as well as the different shrubs and bushes, which have probably been roses. This second division of the house was the most elegant; the paintings with which it was decorated were finished with great care. Near the chamber which we have just mentioned, which may be regarded as a bed-chamber, was the eating-room, and by the side of it the pantry, from which we enter a chamber which appears to have served the purpose of a dressing-room, as various articles of clothing were found in it. Another smaller court, embellished with a basin and columns of different proportions, was near the high road, and led into the great court of the interior, where was the gate which led out into this road. Near the garden are the cold and vapour baths.

At a short distance from this house, we discover near the high road a little sepulchral monument, adorned merely with fasces. An inscription informs us, that a certain Diomedes, a freed-man of Arria, had consecrated this monument for his mistress and her family, as well as for himself and his. The fragments of the columns which were near the tomb of the arch-priestess Mammia, lead us to suppose that it was formerly more elevated than it is at present. On a square base was a circular substructure adorned with columns and marble statues. A gate leads into the first enclosure, or, we may say, into the fore court of the sepulchral monument; the tomb, properly so called, was surrounded by a terrace; some steps conducted to the stylobate, on which are still found some columns. From thence an opening conducts into the tomb, where there are many niches, in the principal of which is an urn, that contained probably the ashes of Mammia. In the fore court were two open excavations, leading into two vaulted caves, which could have no other destination, but to serve as sepulchres. On the wall of the sepulchral monument, and near these excavations, were found masks of colossal magnitude. They do not appear to have properly belonged to the tomb of Mammia, which was of too small proportions. They are those called scenic masks, which renders probable the opinions of several learned men, who have considered this spot as the place of sepulture for the comedians of the city.

The entrance to Pompeii is small, and not striking, nor announcing a city of great importance. The remains consist of fragments of columns, of which several considerable portions have been found lying about, with fine capitals of the Ionic order; perhaps these columns have once supported buildings. On two sides are arcades and porticos, which form the entrance to the foot-paths, that extend along the sides of the high road. This path is extremely narrow, not being more than three feet broad; but this is only proportionate to the high road, which is not more than ten or twelve feet broad, although it may be traced for a distance of fifty or sixty toises. In the ancient level of the street, we still see very distinct traces of the carriage tracks, which prove that there was a distance of four feet between the wheels. At the entrance rises a square pedestal, which appears to have supported a column of considerable size. Many tumulary monuments which are found in its neighbourhood, as well as the inscriptions on the pedestals itself, induce us to consider it as a sepulchral monument. Still nearer the gate are found two circular benches, about twenty feet long, of which one only is well preserved, bearing an inscription, which informs us that this was the place of sepulture of the priestess *Mammia*, which was granted her by a decree of the decurions. This last circumstance, of the place of her burial being assigned by a decree of the decurions, proves that the family of this priestess had great influence at Pompeii.

As we follow their principal street, we still discover the form of different shops, notwithstanding the ravages committed by time and earthquakes. If we judge from a kind of balustrade or wire lattice, which is seen at one of them, it was the shop of a dealer in perfumes and spirituous liquors: below there is a kind of pipe or excavation in marble, but it would be difficult to ascertain its use. In the same street, near the gate of the city, occurs a very singular sign, which has by chance been perfectly well preserved: it is a Phallus or Priapus, sculptured in bas-relief on the stone post of a house. The common opinion is, that it was the sign of a house consecrated to Venus, and this opinion is supported by a remarkable inscription found at Pompeii, and published by Winckelmann, in his *lettre au comte de Bruhl sur les découvertes d'Herculanum*, page 62, of the French translation of M. Jansen. Others have thought that it was the sign of a warehouse or manufactory of those figures which we call obscene, but to which the credulity of past times attached religious ideas, and which were carried by ladies as amulets. Mr. Hamilton thinks that it was more probably the sign of a particular worship, offered to the god of the gardens, as we see at the present time houses having sometimes for a sign the figure of some saint. According to Mr. Hirt, the distribution of the house, which has this Priapus for a sign, proves that it was rather a tavern than a place consecrated to Venus. He thinks it probable that many of the shops in this street were taverns, where they provided the guest with eatables, and where at the same time they prepared warm drinks, that is, that they were *thermopotia*, or a kind of coffee-houses. The same style of architecture and the same distribution universally occurs: several are handsomely adorned with marbles. In these houses were found only the more necessary utensils, but all were well worked, and had elegant forms: they were lamps, candelabra, vessels and kitchen utensils, weights, statues, vases of all sizes, in earth, in bronze, and in glass, many fragments of glass-windows, little idols, ladies' jewels of gold and silver, mirrors, wax, tablets for writing upon, chirurgical and musical instruments, colours of all kinds, medals in gold, silver, and bronze; children's play-things, dice, tooth-picks, boxes of colour, eatables, corn, fruits of different kinds, &c. Neither statues nor busts of great dimensions were found. The best paintings have been found at Herculaneum, not at Pompeii. The wooden utensils were in general either decayed, or carbonized by the heat of the burning cinders.

The temple of Isis is without doubt the most remarkable of the ruins discovered at Pompeii. The columns which surrounded it are almost entirely preserved. Half of those which composed the peristyle have been broken, as well as the capitals and the fronton. The temple itself was entirely built of bricks, and on the outside covered with a very solid stucco, of which the ancients made very frequent use. The style of the architecture is more agreeable than severe. The orders are of a small proportion, which diminishes the effect that the edifice would have had, if it had been of a more imposing style. In this temple have been found all the instruments which appertained to the religious ceremonies, and even the skeletons of the priests who had been surprised and buried by the shower of cinders, in the middle of the occupations of their ministry. Their vestments, the cinders and the coals on the altars, the candelabra, lamps, the sistrums, the vases which contained the lustral water, the pateræ employed in the libations, a kind of kettles to preserve the intestines of the victims, cushions on which they placed the statue of the goddess Isis, when they offered sacrifices to her, the attributes of the divinity with which the temple was every where adorned, &c., are still shown. Many of these vases have the figure of an ibis, of a hippopotamus, of a lotus, and what renders them still more important, they were found exactly in the situations in which they were used, so that there can now be no doubt as to their reality, or their use. The walls of this temple were adorned with paintings, relating to the worship of the goddess: there were figures of priests in the costume of their order: their vestments were of white linen, the heads of the officiating priests were shaved, their feet covered with a fine thin lace, through which the muscles might be distinguished. It appears that in the sanctuary of this foreign divinity, places were assigned for the other divinities, for there were found the statues of Bacchus, of Venus, and of Priapus, chiefly of wood, with feet and hands of marble. All these different objects, that could be carried away, have been deposited in the museum of Portici. The temple had the form of a long square, and was not covered. A covered gallery, supported by columns, surrounded it, and served for a shelter in bad weather. Some steps in the middle lead to a small chapel, which appears to have been the sanctuary of the goddess. At the bottom was probably the place where the initiated assembled, and at the side is another cell in which the three statues of Venus, Bacchus, and Priapus, were found together in a niche. The principal entrance of the temple was on the side of the street of Pompeii, and on each side of it is seen an altar before a figure of the goddess, worked in bas-relief. The grand altar on which the sacrifices were offered, is three feet and a half high. The principal door of the interior sanctuary consisted of two wings: the brass hinges were found, and carried to Portici. Above the gate is an inscription, which sets forth that "Nonius Popidius Celsinus has rebuilt, at his own expense, and from the foundations, this temple of Isis, which had been destroyed by an earthquake, and that, in return for this liberality, he had been, at the age of sixty, received gratis into the college of the decurions." This inscription, as well as the pavement of lava, prove that this district had been already often exposed to volcanic eruptions. On a fine mosaic pavement was found another inscription, from which it appears that this pavement was made at the expense of Corelia Celsa, the wife, daughter, or parent of Popidius Celsinus, who built the temple. The skeleton of a priest which was found on this pavement, has led people to suppose that it was destined for the priests, and for the initiated of the first degree. This skeleton was near a marble table; and it appears that he was surprised, by the volcanic eruption, at the moment he was eating some fish, for in digging they found some relics dispersed, and some of the vessels which were used to prepare this kind of food. We know from Plutarch that the priests of Isis were allowed to feed only on fish. The statue of the goddess, formed of white marble, was found in the sanctuary, placed on a square base. Near it was found a stone covered with hieroglyphics. The statue, as well as the great altar, are of good workmanship. The roof of the gallery, from the fragments of these ornaments found scattered about, was probably ornamented with masks, the water running through their opened mouths. There were also found censers, or *acerræ*, of thin iron, for burning perfumes.

Near the wall, in an elevated situation, are the remains of a temple of Grecian architecture: the remains resemble those of the ruins at Pæstum. The pavement, which still remains, forms an oblong square, and is raised on steps which surround it on all sides. There was a colonnade, which formed a covered gallery. The few remains which are now found of this edifice, would induce us to believe that it had been destroyed in an eruption anterior to that which finally buried the city, as we see was the case of the temple of Isis, before it was rebuilt. Around this monument are still five steps, twelve inches high, and fourteen wide; the entrance was from the side of the sea, and nine steps, six inches high, formed a projection, and led to the peristyle. There appears to have been eight columns in the front, and eleven in the flanks. The mosaic pavement is still in several places uninjured, and shews that the temple had two divisions, the most remote being probably the sanctuary: there still exists a round isolated altar, and on the outside a long square stone, on which the victims were placed. This building appears to be the most ancient in Pompeii. Its dimensions, and the remains of the columns, &c. prove that it was of a noble and majestic architecture. It appears to have been peripteral. The place on which it is built is ninety one feet long, and nearly sixty-four broad: the columns are of the Doric order, their diameter is three feet and a half, and their height appears to have been equal to six diameters. There was found a moulding of baked earth, which probably surrounded the cornice, and which, adorned with the masks before mentioned, served to give a passage to the rain-water.

Between this temple and that of Isis there is a spacious edifice, which, according to all appearance, served as a barracks, and place of arms, for the Roman soldiery, whence it is named the quarter of the soldiers. It has suffered less from the earthquake than many of the others, because it was of less elevation and of a lighter construction. Experience has proved that lofty buildings of a massy construction are much more exposed to destruction by the convulsions of the earth, than buildings of a weaker and lighter construction.

In the quarter of the soldiers, almost all the walls are found uninjured, and nearly all the columns entire. The form of this edifice is that of a long square, and it is surrounded by columns and an open gallery: this gallery communicates with many chambers or cells placed round, and which, probably, were the lodgings of the soldiers. The interior court, which is about twenty-three toises by seventeen, served probably for military exercises. The columns are of the Doric order; they have no base, are eleven feet high, and their diameter is eighteen inches. The gallery between the colonnade and the wall is thirteen feet seven inches wide. It served for a walk, and at the same time to shelter the cells, each of which lodged probably four soldiers, for in each are found four suits of armour. These cells are not all of the same dimensions; all of them are very small, plastered with stucco, ornamented with arabesque paintings, and paved with mosaic. They were shut by means of a folding door, which, as we may judge from the form of the threshold, opened inwards. They received light only by the door, and perhaps sometimes by an opening made in the roof. The dimensions of two of these suits of armour, and the weight of the helmets which were found in one of the chambers, have induced some people to think that they were only trophies, raised for ornament; but, as they were covered with cloth, there is reason to suppose that they were intended for use. Amongst the suits of armour that were found, there was one, on which, according to Mr. Hamilton, was represented the siege of Troy. The helmets resembled those of our ancient warriors in the age of chivalry, and were furnished with vizors. A brazen trumpet was also found, of a singular form, and six ivory flutes, uniting in one mouth-piece, with no holes to vary the notes; the only variation appears to have been caused by the difference in their several diameters. From various circumstances connected with these chambers, it appears that the soldiers, as well as the greater part of the inhabitants of Pompeii, passed most of their time on the terraces and galleries, and that they only resorted to their rooms to sleep, and to take their repast. Some have thought, from the meanness of its accommodations, that this building was only destined for military and gymnastic exercises, but M. Bartels, in his *Lettres sur la Calabre*, proves that it was really a barrack, from its resemblance to the quarter of the soldiers at the villa of Adrian at Tivoli. There are also larger chambers, which are supposed to be the apartments of the officers, as at a short distance from them have been found the skeletons of slaves, and of a horse loaded with clothes and valuable effects, which they were perhaps endeavouring to save. At a short distance was a peristyle of columns with elegant capitals; probably it was the lateral gate. Very near, another gate conducts, by four steps, to a place surrounded on every side by a covered gallery, sustained by columns of the Ionic order.

On the right is the entrance to a small theatre, which is supposed to have been covered: only the steps are seen, the rest being still buried in ruins. Some travellers think that it was an odeon. To the left of the gate of the quarter of the soldiers, are five little divisions or chambers, in one of which was found a handmill, and of which another appeared to have served for a prison to the soldiers, who were put in irons. Several skeletons were found in it, which appear to have belonged to unfortunate soldiers, who, at the moment of the eruption, were then imprisoned, and for whom it was impossible to save themselves. The position of these skeletons shows us that the mode of putting prisoners in fetters resembled that which is still practised in several countries. Their feet were placed on a block of wood, and underneath passed a fetter which held them, and which was fixed to the block by nails. The remains of this building show clearly that it formed part of the theatre, to which it appears to have served as a peristyle. The *proscenium* of this theatre is in a great part discovered, and appears to have resembled in form that at Herculaneum. The covered gallery with which it is surrounded, where are found the *vomitoria*, has also been in a great part explored.

The construction of the houses of Pompeii shows that they must have been built on a very unequal ground, perhaps even on the extinguished crater of an ancient volcano: at least it appears that it had subterraneous communications with Vesuvius, for even now a cellar found under the terrace of a small house is so filled with suffocating effluvia, that, in entering, it is necessary to use great precaution. When this cellar was discovered, a female skeleton was found laid by the side of a great vase, near a stove, which warmed at once two bathing rooms and a dark rotunda, lighted only by an opening in the roof. This place is equally deserving the notice of the antiquary and the naturalist. The vase, beside which the skeleton is stretched on a heap of cinders, is three feet and a half in diameter, and appears to have been used as a bathing-tub. The place where the skeleton was found, and its position, show that the person has been suddenly thrown down, which without doubt was the consequence of an asphyxy, produced by the effluvia. It is to the solicitation and advice of Mr. Hamilton, that travellers owe the preservation of this skeleton in its original position and situation. It certainly makes here a much more lively impression than it would in the cabinet of Portici. The entrance of this cave is still sometimes dangerous, from the mephitic air with which it is often filled: at other times these exhalations are less sensible, so as even scarcely to rise so high as the organs of respiration.

Ponton, (Fr.) a bridge of boats.

Pompeion, (Gr.) a magnificent edifice at Athens, at the entrance of the ancient city, by the side of the port Phalerus, in which all the sacred utensils, &c. (πομπαι) which were used in the celebration of the fêtes, were deposited.

Pontifices, or *Bridge Builders*, were an order of Hospitallers, founded by St. Benezet, about the close of the twelfth century. Their office was to assist travellers, by making bridges, settling ferries, and receiving strangers in hospitals built on the banks of rivers. Of this order, St. John the bridge-maker was a celebrated member.

Poplar, (*populus*, Lat.) this tree is ranked by Carlo Fea among those which were used by the ancient statuaries. See *Timber*, and *Abele*.

Poppy, (*popig*, Sax.) The poppy was a plant greatly venerated by the Egyptians; among the Greeks it was dedicated to Ceres, and is often introduced in architectural ornaments. A red jasper, in the collection of Stosch, exhibits a poppy-head, encircled by a serpent. Frederic Michael Lochnar has collected all the ancient monuments on which the poppy is depicted, in his. "Mekonopaignion; sive, Papaver ex omni antiquitate erutum, Gemmis, Nummis, &c. Æri incisis illustratum," 4to. Noribergæ, 1713.

Porcelain, (Fr.) a beautiful and semi-transparent kind of earthenware, principally manufactured in China. The Chinese (who are totally unable to pronounce the name given to it by Europeans, their language comprising no such sounds) call it *tse-ki*, and the two chief ingredients employed in it, which are formed into a paste, *pétun-tsé* and *kao-lin:* the former consists of fragments of rock extracted from certain quarries, and reduced to a fine powder, of a colour inclining slightly towards green, the other appears to be nothing else than a very pure white sand, intermixed with shining particles. The vessels, &c. of porcelain are, in China, made in separate parts, which are cemented together with some of the same paste softened in water, and the seams being polished with an instrument on both sides, no trace is visible after it is covered with varnish. The painters of the porcelain, who are called *hoa-pei*, are ignorant people, possessing no other art but that of mechanical practice, and content themselves in general with making absurd and monstrous figures. Porcelain, among the Chinese, is not unfrequently used in building. In the vast plain near the city of Nankin, there is an octagon tower, with nine arched stories, incrusted in the interior with marble, and on the outside with porcelain, whence it has become celebrated by the name of the *porcelain tower*. At each story is a gallery, and all are covered with roofs of a green colour, supported by gilded rafters, from which hang little copper bells. The highest point of the building is surmounted by a pine-apple, said to be of solid gold, and the pieces of porcelain are placed so skilfully, that it is next to impossible to detect the place where they join, whilst the whole is adorned with lead and enamel, glazed with green, yellow, and red, glittering at a distance like gold, emeralds, and rubies. This tower is said to have stood eight hundred years, without receiving any injury. A figure and full description is given in Fischer's "Essai d'Architecture Historique." The manufacture of porcelain appears to be very ancient, and it is believed to have been once practised by the Egyptians. Very successful potteries have been of late established in several countries of Europe. On the history, &c. of porcelain, the reader may consult — Pére d'Entrecoller, in the Recueil des Lettres Edifiantes; Du Halde, Histoire de la Chine; Recueil des Observations Curieuses; and, Milly sur l'Art de la Porcelaine.

Porch, (from the Lat. *porticus*,) an arched vestibule at the entrance of a church, or other building.

Porchester Castle, near Portsmouth, appears to be partly of Roman construction, with modern additions and alterations by the Saxons, Normans, &c. The walls, which are nearly twelve feet thick, have in many places a passage covered with a parapet round them. The western entrance is under a square tower, and over the gate on the inside are two figures which bear some resemblance to Egyptian sphynxes: this gate, as well as the eastern, is fourteen feet wide. The keep has four towers, three of which are on the outside wall, the one forming the north-west angle being much the largest: the buildings of the keep cover an area of sixty-five feet by 115. In some of the round towers are still visible regular rows of Roman bricks, which divide the layers of stone work. The *sacellum* of the Roman *prætorium*, is supposed by Mr. King to have occupied the site of the present parish church, which is a very old building.

Porphyry, (from πορφυρος, Gr. *purple*,) a very hard stone, partaking of the nature of granite. It is designated by Pliny under the name of *porphyrites*. Winckelmann (Observations sur l'Historie de l'Art,) is wrong in pretending that it is not certain that porphyry was produced in Egypt. It is probable that the Egyptians, who bestowed greater attention on *syenites*, for a long time neglected the *porphyrites*, and that on this account no works in porphyry can be proved to be of very great antiquity; in fact, there are few remains of works in porphyry, that are purely Egyptian. The mixture of red (or rather purple) and white was not approved by the ancient artists, and this substance was never employed for sculpture in the best ages of the art. Pliny, after having related that Vitruvius Pollio, governor of Egypt, presented to the emperor Claudius some statues of porphyry which he had brought from that country to Rome, adds, that they were regarded as fantastic novelties, and that none approved of works in such materials. From this we may judge that the number of statues in porphyry among the ancients cannot have been very considerable. This substance appears to have been much better calculated to be used in columns, for funerary monuments, for urns, &c. of which there is a great number at Rome in the baptistry of St. John, in the church of St. Constance without the city, in the Museo Pio-Clementino, &c. Pliny and Anna Comnena speak of columns of porphyry, which ornamented the interior of the Egyptian labyrinth. The most celebrated quarries of porphyry were in Egyptian Arabia, that is, in that part of Africa which joined Egypt, and which was often confounded with Arabia. But the great number of porphyry columns found at Palmyra leads us to presume that it was also found in the eastern or Asiatic Arabia.

Porphyry is less fine than many of the ordinary marbles, but far exceeds them in hardness, and is capable of bearing a high polish. It is still found in Egypt in immense strata. It is generally of a high purple, which varies however from claret colour to violet. Its variations are rarely disposed in grains. The red-lead coloured porphyry, which is found in great plenty in Minorca, variegated with black, white, and green, is a beautiful and valuable material. The pale and red porphyry, variegated with black, white, and green, is found in huge veins in Arabia Petræa and Upper Egypt, and in separate nodules in Germany, England, and Ireland. Ficoroni mentions two exquisitely fine columns of black porphyry in a church at Rome, and three celebrated obelisks of porphyry have been found in Egypt, two at Alexandria, and one at Cairo. (See *Obelisk*.) M. Ferber, in his "Lettres sur l'Italie," has given details of the different kinds of ancient porphyry, which he observed at Rome. The dark red porphyry, *porfido rosso*, is there the most common: it is of a deep red, with oblong white spots: the latter are of *feld-spath*, which resembles schorl. There are two varieties of black porphyry, *porfido nero;* that which is more peculiarly called black porphyry, and that which they call *serpentino nero antico.* The first has a ground entirely black, spotted with oblong white spots, like the red porphyry: the other has also a black ground, with great white spots oblong or rather in the form of a parallelopipedon, nearly resembling in colour what the French call *serpentin vert antique.* The *brown porphyry,* has a brown ground, with large oblong greenish spots. There are several kinds of *green porphyry,* which the Italians distinguish into *serpentin vert antique,* and green porphyry properly so called. The first is found in great abundance, and in large blocks, in the neighbourhood of the ancient Ostia, the port where Egyptian vessels loaded with this stone unshipped their cargoes, and is of a green ground, with oblong spots of a lighter shade of the same colour. The *green porphyry,* is of a very dark green ground, almost blackish, with lighter shades, sometimes of a fine grass green.

The art of cutting porphyry, as practised by the ancients, appears to be now quite lost. The tomb of Constantia, the daughter of Constantine, still extant in the church of St. Agnes, and commonly known by the name of the tomb of Bacchus, is finely worked in this substance, and in the palace of the Tuilleries there is likewise a bust of Apollo, and of the twelve emperors, all in porphyry. Da Costa (Nat. Hist. of Fossils, p. 285,) imagines, that the ancient mode of working porphyry was simple, and that they had no scientific process, but that they first rudely hewed it down with great diligence with common tools, and afterwards rubbed it down by means of hard sands found in Egypt, or of a kind of grit analogous to the substance itself, which they might find in the porphyry quarries. Some, on the contrary, think the ancients had the secret of tempering steel better than we, and others that they possessed means of softening the porphyry. Addison saw a workman at Rome engaged in cutting porphyry, but says that his advances were extremely slow, and, in fact, almost insensible. Many have attempted to discover the ancient art, which they imagined to be lost. Cosmo di Medicis, in 1555, is said to have distilled a water from certain herbs, by help of which his sculptor, Francesco Tadda, gave his tools such an admirable hardness, and so fine a temper, that he performed most exquisite works, among which were heads of Christ, of Cosmo, and of his duchess, in demi-relievo; in these the very hair and beard are well executed, and equal in every respect to the remains of ancient art in the same substance, but the secret appears to have died. The French have invented the use of an iron saw without teeth, *grez,* (a kind of freestone in powder,) and water, for cutting porphyry. Some have proposed to harden the tools by steeping them in the juice of the plant called *bear's-breech.* Mr. Boyle recommends the use of emery, steel saws, and water.

PORT, (*portus,* Lat.) a small gulf so hollowed and disposed by nature or art, as to contain vessels in safety, and to facilitate their loading and unloading. Sea-ports are commonly enclosed by moles, thrown out into the sea, and protected by batteries. The most celebrated ports of antiquity were those of Carthage, of Alexandria, Syracuse, Rhodes, and Messina. The famous city of Tyre had two; the largest was nearly oval, the entrance formed by two moles, stretching out into the sea in the form of segments of circles: a third mole covered the entrance, and protected the vessels from the impetuosity of the waves. Two lofty towers, at the head of this mole, served to defend the two mouths thus formed, and on their summits were placed lights to guide the navigators. The second port of Tyre was destined for merchant ships, and had nothing remarkable in its entrance, which was adorned with magnificent architecture, and covered by an advanced mole.

The harbour of Peiræus, the port of Athens, although subject to some inconveniences, is still an excellent port for vessels as large as frigates. The Peiræus was anciently subdivided into three harbours, which caused Themistocles to recommend its use to the Athenians, but it was not till the second year of the Peloponnesian war that they saw the necessity of fortifying it. Its three ports then became closed harbours, (κλειστοι λιμενες) as Munychia and Phalerum had probably long before been made. The expression κλειστοι λιμενες, which frequently occurs in ancient history is illustrated by many examples in the ruins of the maritime cities of Greece. Their harbours were generally small land-locked basins, such as the coasts of Greece particularly abound in, and they were enclosed within the circuit of the town walls, that is, the walls being carried down to either side of the harbour's mouth, were prolonged from thence across the mouth upon shoals, or artificial moles, till a passage only was left in the middle for two or three triremes abreast between two towers, the opening of which might be further protected by a chain. This kind of harbour was not out of use in the Levant, as long as the *Armata Sottile*, as the Venetians called that part of their navy which consisted of galleys and galliots, continued to be an object of importance among them, and to have opponents of the same kind among the Turks, and the other naval powers of the Mediterranean.

The traces of the works which closed the three ports of the Peiræus being still perfectly apparent, its three divisions are exactly determined. The entrance of the outer port is marked by an insulated rock, lying towards the eastern shore: this port extended inward as far as two reefs, which, projecting from either shore, form a second narrow passage, now indicated by two small masses of modern masonry. Anciently the reefs afforded a foundation to two projecting walls, the opening between which was the communication from the outer to the middle port. This was by much the largest of the three, and contained all the portion of the Peiræus now in use, and extended as far as the shore at the modern custom-house and convent of St. Spyridion, leaving on the north side a third narrow entrance, leading into a circular basin, the regular form of which, and the walls which were carried across the entrance, with the exception of an opening in the middle, furnish undoubted proofs, that it was one of the three Peiraic ports, though, from the neglect, and the alluvial deposits of a small stream, it has been rendered now a mere lagoon. (See Leake's Topography of Athens.)

The port of Ostia was not one of the least celebrated amongst the Romans. Suetonius attributes it to Claudius. The mole at the entrance was of such extent, that Dio calls it an isle. This port was situated at the mouth of the Tiber, opposite to Sardinia. It had two entrances, with a large pharos, like that of Alexandria, in the middle, to guide the vessels in the night. The emperor Trajan repaired this port, enlarged it, and even doubled its former size, shutting it up in the form of a hexagon. Thus improved, it afforded a safe and most commodious harbour, and at the same time presented to the eyes all the pomp and grandeur of architectural decoration, in the splendid edifices which surrounded it, and amongst which were warehouses, magazines, vast manufactories and depôts, hotels for strangers of every class, and even palaces for the ambassadors who might be on their way to Rome. The port of Ostia, with its hexagonal form, is shown in Montfaucon, Antiq. Expliq. tom. iv. part 2, pl. 143; and in the Recueil et Parallele of MM. Durand and Legrand, pl. 25, after the design of Serlio. The medals of Nero represent this port almost round, but it is hexagonal on a medal of Trajan, with the inscription PORT. OST. Perhaps, in forming it round, the designers of the medals had no intention of giving the exact form of the port. Montfaucon, Suppl. à l'Antiq. tom. iv. pl. 49 *bis*. no. 2, has published an inscription in memory of a procurator or inspector of this port: *Claudii Optati Augusti liberti procuratoris portus Ostensis*. The same antiquary has given, from a manuscript of Peiresc, in Pl. 49, the plan of the ancient port of Frejus, which was almost triangular, and of considerable extent; on each side of its entrance was erected a tower, and in the middle of the port was the ruins of a fortress. On the west bank, near the extremity, was a kind of ruined gateway. This port is now dry, and at some distance from the sea. Pl. 49 *bis*., of the same work, exhibits an engraved stone, representing a port with its round pharos, placed on a very high and steep rock. A description of other ports will be found in the Hydrographie of Fournier, and in the Architecture hydraulique of Bélidor.

PORTAL, [*portail*, Fr. from Lat. *porta*,] the arch over a door or gate; the frame-work of the gate; the lesser gate, when there are two of different dimensions at an entrance: the vast *trilithons*, or frames of the entrances of the edifices at Persepolis, and in ancient ruins in other parts, are called *portals*. The name is also given to a little square corner of a room, separated from the rest of the apartment by wainscoting.

PORTCULLIS, [Fr.] a strong grating of timber, fenced with iron, and made to slide up and down in a groove of solid stone-work within the arch of the portal of old castles. The bottom was furnished with sharp iron spikes, designed to strike into the ground, for the sake of greater firmness and solidity, and also to break or destroy whatever should be under it, when it was let down. Portcullises were used among the Romans. The portcullis is believed to have been first introduced to the military architecture of this country, in the instance of early Norman castles.

PORTICO, [*porticus*, Lat.] a long covered space, composed either of vaults supported by arcades, or of flat roofs supported by pillars, the sides being quite open. In the time of Homer, the portico, *αιθουσα*, does not appear to have been constructed with columns.

Twice only is it mentioned, that these porticos were polished or well wrought, and in one instance he alludes to the divine mansion of Jupiter himself, in the other to the splendid palace of Priam. (Il. xx. 11. vi. 242.) "It seems," says the translator of Vitruvius, Mr. Wilkins, "to have been a species of raised platform or exedra, probably covered at the top, but exposed at the sides to the air, and to the enjoyment derived from this exposure, we may chiefly attribute its origin." One of the principal porticos at Athens was the Pœcile. At Rome they were very numerous. Vitruvius and Columella prescribe the manner in which the portico ought to be turned, that they might be convenient places of resort at all seasons. Pliny, speaking of the porticos or galleries which he had in his country-house, gives such a description of it, as even now to excite our admiration. In plate P. I. are represented porticos of temples of the Doric and Corinthian orders.

Portico of Philip, in the isle of Delos, a ruin described by Stuart. It is a fine specimen of the Doric order, and is remarkable for the lightness of its proportions. Mr. Stuart conjectured it might have been erected by Philip, after the Sacred war. The shafts of the columns appear to have been left plain, for the purpose of future completion. Among the architraves were three lying pretty near each other, with inscriptions in memory of Philip. Each architrave was ten feet long, two and a half thick, and one foot eight inches deep. There are also in this island the remains of a Doric temple dedicated to Apollo, of which the shafts of the columns are fluted at their upper and lower extremities, and left plain in the middle. The aspect of this temple, from the appearance of the ruins, was conjectured to have been peripteral, and it was judged to be nearly equal to the temple of Theseus. In this island have been found capitals with bulls' head and shoulders attached to them. Figures of them are given in the supplementary volume to the last edition of Stuart. They were found near a portal or gateway, on the ascent of mount Cynthus, formed to support the wall of an ancient fortification of that height; this entrance is constructed with ten large stones, inclined to each other like those at the aperture to the great Egyptian pyramid. It is perhaps the earliest specimen in Greece, of the architecture termed Pelasgic, displaying the first step toward the principle of the arch, and was probably executed by the colony settled here by Minos. In the supplementary volume of the last edition of Stuart's Athens, is given a restoration of one of these capitals. The bulls, with those on the triglyph, doubtless belonged to some edifice dedicated to the worship of Mithra, who among the Persians personified the sun. At Persepolis, and in the vicinity, tauriform capitals are yet in existence; and a Silician coin, engraved also in the supplementary volume of Stuart's Athens, bears an emblem alluding to the worship of the bull. Kneeling bulls are introduced in the frieze of the temple of the sun at Balbec, (Cassas. Voyage Pittoresque de la Syrie, tom. ii. pl. 16, 17.)

Porticus, in ancient churches, appears to have been a portion of the west end, dedicated to some saint, &c., not resembling our modern *porches*; (See Britton's Architect, Antiq. vol. v. p. 118, 119.)

Portland Stone, [the [illegible]

arenarium Portlandicum of Da Costa, and the *psadurium hebes, albidum, laxius*, of Hill,] a dullish white kind of sandstone, brought from the isle of Portland in Dorsetshire, and much used in London. The piers and arches of Westminster-bridge are of this material. It is very soft when it comes out of the quarry, but hardens by time and exposure to the air. See *Stone*.

Porus, (Gr.) or *lapis porinus*, a species of marble, which, according to Theophrastus and Pliny, resembles in its beautiful white colour, and in its quality, the marble of Paros, with which some have confounded it. It is now unknown. It was found in Elis, and Pausanias informs us that the temple of Jupiter Olympius was built of it. Some authors mention statues made of it, and it was used particularly for engraving inscriptions on. Ernesti thinks that the marble called *porus*, or *lapis porinus*, is the same as that which the Italians now call *peperino*.

Position, in geometry, the situation of one thing in regard to another.

Post, (Fr.) a piece of timber set erect in the earth; certain ornaments of the shape of rolls or wreathings.

Post and Paling, a close wooden fence, made by posts fixed in the ground, and pales nailed between them. This kind of fence is sometimes called *Post and Railing*.

Postern, (Fr.) a small door or gate at the back of a building. *Posterns*, in ancient castles, were entrances for the private ingress of messengers to the governor.

Posticum, (Lat.) the porch in the back front of an ancient temple.

Postique, (Ital.) an ornament, &c. added after the rest of the work is done.

Postscenium, (Lat.) the back part of the ancient theatres, where the machinery was desposited, and where the actors retired to robe themselves.

Poultry House, a building for keeping poultry in. There is a most magnificent building of this kind at the seat of lord Penrhyn, at Winnington, in Cheshire, consisting of a handsome regular front of 140 feet, with an elegant pavillion at each end, which are united to the centre by a colonnade of small cast-iron pillars, which support a slate roof, that covers a paved walk. In the centre of the front are four handsome stone columns, and as many pilasters, supporting also a slated roof, with an elegant iron gate between them. Behind is a large semicircular court, with a colonnade round it, and places for the poultry. On one side of the gate is a little parlour, and at the other end of the colonnade a neat kitchen.

Powderings, devices to fill up vacant spaces in carved works, &c.

Præcinctio, (Lat.) or *balteus*, a kind of wide seat or rather step, round the entire circumference of the ancient theatres and amphitheatres. It was termed *διαζωμα* by the Greeks, as may be seen in the inscription at Patara, (see *Theatre*,) which determines the meaning of the word in Vitruvius. See *Amphitheatre*.

Præfurnium, see *Propnigeum*.

Prætorian Camp, was, as its name indicates, destined for the purpose of including, within one enclosure, the cohorts which were under the prætorian prefect. Sejanus, the minister of Tiberius, having occupied this station, wished that all the soldiers of the prætorian cohort, whose quarters were before dispersed, should be collected in one vast edifice, which he ordered to be erected, and which was called *castrum prætorium*, or *castra prætoriana*. Authors are not agreed as to its exact situation; but it is believed to have been situated to the east of Rome, between the roads Nomentana and Tiburtina, behind the baths of Dioclesian, and near the walls of the city. This camp was built of brick, in the reticulated mode of masonry, covered with stucco, and adorned with superb porticos. Constantine caused it to be demolished, but it appears to have been rebuilt by the care of Pirrho Ligorio. In the centre was the *prætorium*, or tribunal, in which the prefect delivered judgment. It had the exterior form of a temple; the interior was plain: its only ornament was a table covered with a purple cloth, embroidered with gold. The camp was surrounded by an enclosure, which in some places was double, within which were built the quarters of the soldiers, two stories high, the communication between them being formed by vast colonnades. The exterior towers gave it the formidable aspect of a fortress. The great space which it enclosed, favoured the health of the troops, and afforded room for them to exercise. MM. Durand and Legrand, in their valuable "Recueil et Parallele des édifices anciens et modernes," (Pl. 26,) have given the plan of this superb monument. Whatever be the degree of authenticity that we may be inclined to yield this plan, or whoever be the restorer of this edifice, it is impossible to excel a disposition so well contrived, so conformable to the ancient character, and to give it more elegance, without diminishing its convenience. On the same plate are exhibited the small camp of Pompeii, and that of Otricoli.

PRÆTORIAN GATE, see *Castra*.

PRÆTORIUM, (Lat.) see the foregoing article. The name was also often given to any building where causes were judged by the prætor, and also to patricians' seats or manor-houses, in the country

PREACHING CROSS, see *Cross*.

PRECARIUM, in Roman villas, a counting-house.

PRECEPTORIES, manors or estates of the knights templars, on which they erected churches for religious service, and convenient houses for habitation, and placed some of their fraternity under the government of one of those more eminent templars who had been created by the grand master *præceptores templi*, to take care of the lands and rents in that place and neighbourhood: these preceptories were only cells to the temple, or principal house of the knights in London.

PRESBYTERY, the part of the church appropriated to officiating priests, comprising the choir, and other eastern portions of the edifice. In Roman Catholic countries, the term is applied to religious houses near any given parish, wherein all such priests as are considered to merit such distinction, are lodged and boarded in common.

PRICK-POST, the same as *Queen Post*.

PRIENE, an ancient city of Asia Minor, at a few miles distant from Miletus. The temple of Minerva Polias, which is supposed to be of the age of Alexander, is described in the first volume of the Ionian Antiquities, p. 13. Its site is covered with ruins so confusedly heaped together, that neither the number of columns in front can be distinguished, nor its aspect or species be determined. The upper step, the only one that can be measured, is 1' 1"2. The base is Ionic, and has no plinth. The torus is elliptical, and fluted. The eyes of the volutes of the capitals are bored two inches and a half deep, perhaps for the convenience of fixing festoons of flowers, and the other apparatus with which the temples were adorned on days of festivity. The hem, or border, with its fillet, resting on the echinus, and connecting with a graceful sweep the spirals of the volutes, adds much to the beauty of the capital. The spiral of the volute has four revolutions. The cymatium under the dentals has three mouldings, a fillet, a cyma inversa, and, beneath that, a fascia or band. Neither the diameter or altitude of the columns could be obtained.

Prime. Any figure in geometry is said to be prime, when it cannot be divided into any other figures more simple than itself, as a triangle in plane figures, and a pyramid in solids. A *prime number* is one that cannot be divided by another number without a remainder.

Priming, among painters, the laying on of the first shade of colour.

Principal Brace, a brace immediately under the principal rafters.

Principal Point, in perspective, a point in the perspective plane, on which a line drawn perpendicularly from the eye to the plane falls.

Principal Rafters, the two inclined timbers which support the roof.

Principal Ray, in perspective, the line passing from the eye to the *principal point* on the perspective plane.

Principalis, see *Castra*.

Priory, a building of the same nature as a monastery, or abbey, whose governor was denominated a prior, or prioress.

Prism, (Gr.) a solid of which two of the faces are parallel, equal, and similar plane figures, and similarly situated, and of which the remaining surface or surfaces between them may be in contact with all the intermediate points of a straight line, intersecting each edge of each of the two faces, while the line moves parallel to itself. The two parallel faces are called the *ends* or *bases*. The edges of the two ends are called the *directrices*. The moving straight line, in which all its points between the two bases are in contact with the intermediate surface, is called the *generatrix*. When the generatrix would be at oblique angles to each of the bases, if it cease to move in any of its positions, it is called an *oblique prism*. A triangular prism has its bases triangles, a *square prism*, its bases squares, &c. If the two directrices are endless curves, it is an *oval prism*, if circles, a *circular prism*, if ellipses, an *elliptic prism*. If the directrices be circles or ellipses, the surface between the prism is called a *cylindric surface*. To find the solidity of a prism, find the area of one of the ends, and multiply it by the perpendicular distance between the ends. To find the surface of a right prism between the two bases, multiply the perimeter of one of the ends by the length of one of the perpendicular edges, or by the perpendicular distance between the bases, and the product will be the area of the surface or surfaces between the two bases.

Prismoid, (Gr.) or the frustum of a wedge, a solid which has two parallel rectangular faces, and the remaining faces trapezoids, terminating with their parallel edges in the same lines as the two parallel faces, which are called the *ends*. The greater end is called the *base*. The length of a line intercepted between the two ends, and perpendicular to one of them, is called the altitude or height of the prismoid. See *Pyramid.*

Prison, (Fr.) a strong building for the confinement of criminals or debtors. From the different passages of the Greek and Roman writers, where these buildings are mentioned, it appears that they were composed of divisions or cells more or less disagreeable: sometimes the prisoners were kept only in a simple vestibule, where they were permitted to see their parents or their friends, as appears from the history of Socrates: sometimes, for it seems to have been regulated by the nature of their crimes, they were shut up in dark subterranean cells, and in moist and infectious holes, such as that in which Jugurtha was immured, according to the account of Sallust. The establishment of prisons at Rome is attributed by Eutropius to Tarquinius Superbus; others attribute it to Ancus Martius, and they say that Tullus Hostilius added to them a kind of dungeon, which was for a long time after called *tullianum.* According to Juvenal, during the time of the kings and the republic, there was but one prison at Rome. Under Tiberius a new one was constructed, which was named the *Mamertine* prison. The Acts of the Apostles, and the whole ecclesiastical history of the first ages, prove that there was then scarcely a town in the empire which did not possess a prison, and the *jurisconsulti* often speak of them in their commentaries on the laws. The expression *mala mansio,* which is found in Ulpian, signifies, according to some critics, a prison. The places known by the name of *latomiæ* and *lapidicinæ*, have been taken by some authors for the mines, to which some criminals were condemned; but it appears that they were real prisons hollowed in the rock, or vast quarries, of which all the outlets were carefully closed. The Roman laws mention different officers who had either the care, or inspection, of the prisons and prisoners. Those who kept an account of the expenses of the prison of which they had charge, of the age and number of their prisoners, and of the nature of the crime with which they were accused, were named *commentarii.* There were some prisons called *free*, because the prisoners were not shut up, but only committed to the care of a magistrate, a senator, &c. or confined to a particular house, or even in their own, with permission to go out. The laws of Trajan and the Antonines prohibited domestic prisons, or what the French call *chartes privées;* but in some instances a father was permitted to confine at his own house an incorrigible son, an husband to inflict the same punishment on his wife, and for greater offences a master was allowed to imprison his own slaves, which was in a place called *ergastulum:* see this word.

In the "Recueil et Parallèle" of Durand and Legrand, are given plans and elevations of modern prisons. The plan of the *maison de correction* at Ghent, which resembles, in an octagonal form, a great number of insulated houses approaching to one common centre, is very ingenious, as it greatly facilitates the inspection and superintendence of the whole. The prison of Aix, built by M. Ledoux, in a style somewhat resembling that of the Egyptians, is on a very simple plan. On the same plate of the above work which contains the plan of these buildings, is one of the "*maison de correction*" at Rome, that of Milan, that of Amsterdam, and the prison of Newgate, which, M. Millin observes, is built in "a style approaching the severe architecture of Florence."

Mr. Howard observes, that "a county gaol, and indeed every prison, should be built on a spot that is airy, and, if possible, near a river or brook;" but "not so near as that either the house or yard shall be within the reach of floods. If it be not practicable to build near a stream, then an eminence should be chosen, for as the wall round a prison should be so high as greatly to obstruct a free circulation of air, this inconvenience should be lessened by rising ground, and the prison should not be surrounded by other buildings, nor built in the middle of a town or city."

Proaulion, a term amongst the Greeks, for what the Romans called *vestibulum*, the passage which conducted from the exterior to the interior of a building.

Prodomus, (Gr.) a term sometimes given to the portico, at the entrance of the cella, and to the façade of the temple.

Producing, in geometry, the continuing a right line to any required length.

Profile, (Fr.) the perpendicular section of a building. The term is also used in speaking of the contour of an architectural member, as of a base, cornice, &c. It is on the just proportion of their profiles that the chief beauties of the different orders of architecture depend. The ancients were most careful of the profiles of their mouldings. The good effect which these produced, depended on the members that were employed, as well as on their disposition and perfections. In this respect the Greeks have been skilful masters. The profiles of the capitals, of the bases, of the entablatures, and of the different mouldings which are offered to us, in the works of the Grecian artists, abound in precision, spirit, and expression, and communicate to the whole a certain warmth and life. They never overloaded their entablatures with members, as the edifices of the Romans offer us examples in later ages; they employed but a small number, and each had its peculiar design. These members are disposed in the most agreeable situations, they offer a variety in their form and height, and their projection is determined by the most exact proportions. In each profile there is a principal member, to which all the others are subordinate. The face of the principal member is always rectangular; those which serve to support or to cover it, have their profiles traced with a curved line. The members which are designed to sustain or cover, are strong towards the extremities; those on the contrary, which only serve to form a separation are delicate. The effect of the profile depends much on the degree of projection given to each member. When this projection is too diminutive, the profile will have a cold and mean air: when, on the contrary, the members have too much projection, it will appear clumsy. The ancients avoided these two faults with great success; and, according to Vitruvius, their method was to give each member a projection equal to its height. The best works of antiquity support the authority of Vitruvius; although sometimes the whole height of several members was given to the most elevated member, that it might cover the other inferior members which were below it, and which depended upon it.

Projection, a branch of pers

spective, "the art of forming the representation of a body upon a plane, by drawing straight lines through a given point, or parallel, from the contour, and from the intermediate lines of the body, if any, so as to cut the plane; then colouring the respective compartments according to the degree of light, shade, and hue, of each surface." (Nicholson.)

Projecture, the prominence of the mouldings and members beyond the naked surface of a column, wall, &c. They are termed by the Greeks *εκφοραι*, by the Italians *Sporti*, and by the French *saillés*. See *Profile*.

Prolate, (Lat.) a spheroid is said to be *prolate*, when it is produced by the revolution of a semi-ellipsis about its long diameter; when revolved about its short diameter, it produces an *oblate* spheroid.

Pronaos, (Gr.) the front porch of an ancient temple.

Propnigeum, (from Gr. *πνιγω*, to suffocate,) the chamber in the Roman baths, placed under the different portions of the bath, as the *Laconicum*, &c., for the purpose of given heat to them. It was also named *præfurnium*.

Proportions, see *Architecture*.

Proportional Compasses, see *Instruments*.

Propylæa, the buildings which fronted the only entrance to the Acropolis of Athens. Some information relating to these buildings, and more particularly to their fortifications, have been given under the article *Acropolis*. They were commenced during the administration of Pericles, and were finished in five years, Mnesicles being the architect. Several plates of the Propylæa are given by Stuart, from drawings in possession of the society of Dillettanti. Before the Propylæa stood two lofty piers, on each of which was placed an equestrian statue. On the right of the Propylæa was the temple of Victory without wings, whence there is a prospect of the sea, and on the left was an edifice adorned with paintings, the work of Polygnotus. The remains of the temple are described by Wheler; "it is built of white marble, and one of its ends is near the wall. It is not above fifteen feet long, and eight or nine broad;" the frieze "has a basso-relievo on it of little figures well cut." The three contiguous buildings originally formed one front, occupying the whole breadth of the rock from side to side at its western end, so that the only admission into the Acropolis, was through the middle building the five gates of which are still remaining. Here we must suppose was placed the Hermes Propylæus, and perhaps the Graces, which were sculptured by Socrates. The great front vestibule is divided by six Ionic columns into three ailes, through the central one of which carriages passed. The road through the Propylæa was made practicable by an inclined plane intersecting the flights of steps, and traversing the entire edifice. The central intercolumniation was made ditriglyph, to afford sufficient width for the passage of the quadrigæ. In the interior of this part of the building, there is an ascent of four feet eight inches by five steps. The central wall is remarkable for the massive marble lintels which covered its five gates, that of the central gate being a solid mass, 22 feet 6 inches long, 3' 10" 3 high, and 4 feet wide. The interior of the door-ways was lined with marble, parts of which still remain. On excavating, according to M. Fauvel, two steps were found next the interior of the east portico, and a low one outside stepping into the Acropolis. At the front portico there are four steps. There was only one step to the inner portico of the Propylæa of Eleusis. The substruction of the right wing of the Propylæa beneath the western wall is not parallel with the plane of the wall above, but diverges somewhat towards the north; it consists of about twelve courses of a deep coloured hard breccia. The left wing is much dilapidated, but evidently had three columns in front, probably *in antis*, as in the other wing. The present horse-road into the interior of the Acropolis was formed, probably, when one of the Frank princes closed up the central opening, when the great vestibule was converted into an arsenal; it may probably have received its direction from an ancient private or privileged entrance, at this angle of the building. The columns consist of eleven frusta, including the capitals. The epistylia extend from centre to centre, and are in three thicknesses, like those of the Parthenon. The metopæ of the front portico appear to have been decorated with sculpture. The exterior marble walling is constructed without mortar, in blocks of one thickness, the courses of which are 3. 10′ 5″ long, and 1. 7′ 5″ high. When the Greeks came in possession of the Acropolis during the late war, they made two discoveries in the Propylæum. One was, a small subterraneous chapel under the right wing, which appeared to have been long filled with rubbish; the other was the celebrated fountain of Pan, rising so near the north-west corner of the citadel, that it was immediately enclosed by a new bastion. The entrance to the subterranean chamber is by a descent of steps from the interior of the outwork, beneath the north wing; and the well is, according to the accounts of the travellers who have visited the place since its discovery, in it. The chamber is decorated with paintings of Greek saints, executed in the middle ages, and the colours are still vivid. See, for further details of these buildings, the fifth chapter of Stuart's Athens, and the notes of his editor—Meursii Attica—Hughes' Travels—Unedited Antiquities of Attica—Leake's Topography of Athens—Waddington's Visit to Greece.

In the plan of the Acropolis of Athens, (plate *Acropolis*,) the following references are not mentioned in the article to which it belongs.

a, pedestal of Rome and Augustus.

b, site of the temple of Minerva Promachus.

c, site of the temple of Diana Brauronia.

d, site of the temple of Venus Leæna.

e, the Erectheium.

f, the Dionysiac Theatre.

g, the Odeon of Herodes.

h, a grotto identified with the sanctuary of Apollo and Pan, described by Pausanias. Just before it is a spring of running water.

i, a ruined mosque, which Stuart supposes to have been an ancient christian church, established on a still more ancient temple.

k, a gate with an elegant little basso relievo over it, representing a deceased husband and wife meeting in the shades.

l, *l*, the remains of an ancient portico.

m, the choragic monument of Thrasycles, &c. now the church of *our lady of the grotto*.

n, *n*, a level space cut at the foot of the rock, supposed to be a part of the Pelasgic wall: a short distance to the south stood a temple of Eleusinian Ceres.

o, a grotto, the supposed hieron of Aglaurus.

p, *p*, *p*, wall of the outworks, rudely built, and of little strength.

s, a little gate to the north of the Acropolis, the entrance to a kind of outwork, through which we pass to go to the Propylæa.

q, a small fort facing the gate.

r, another little fort.

t, another small fort.

u, u, foundations of an ancient wall, of hewn stone, well built, perhaps the Pelasgic wall.

v, v, a wall extending from the lower ground battery to the Odeon.

The following are the references to the second plan in the same plate, which is that of the *Propylæa*, on a larger scale.

A, the outer modern gate.

BCD, termination of the southern wall of the Acropolis.

F, pedestal of the statue of Agrippa.

f, the supposed site of the pedestal of the statue of Augustus.

G, carriage entrance of the Propylæa.

H, the Propylæum, or great vestibule.

I, northern wing.

K, southern wing.

L, supposed site of the postern at the northern inner gate.

M, the central of the five gates, which led from the Propylæum into N, the back portico, which descended by three steps upon O, the platform of the Acropolis.

P, the temple of Ceres and Terra, under the platform R, upon which stood the temple of Victory.

S, termination of the northern wall of the Acropolis.

T, steps cut in the rock, by which there was anciently a descent from the Propylæa by the grotto of Pan into the city.

e, supposed site of the temple of Themis.

g, gate and passage under the battery.

h, modern road from the town to the Acropolis.

i, supposed site of the sanctuary of Venus and Peitho.

k, direction of the ancient road to the Lenæum, Olympium, &c.

l, supposed site of the temple of Æsculapius.

m, road to the Portæ Melitides, Peiraica, &c.

n, supposed direction of the ancient carriage road, from the north side of the city.

In this plan, the ancient works still existing are shaded, those presumed dotted; the Turkish works are described by thin lines without shade, but, to avoid confusion, the modern works in the Propylæa are omitted. The arrows show the direction of the modern road, which Mr. Leake supposes to be the same as the ancient road from the outer gate A to the upper Turkish battery.

The Propylæum of Eleusis was built in imitation of that of Athens. The Eleusinian Propylæa had a great advantage in point of symmetry over that of Athens, on account of its situation, but what was gained in general effect was counterbalanced by the want of that high finish so conspicuous in the execution of the buildings of Athens. Amongst the novelties which the details of the interesting buildings at Eleusis present us, is the method of covering the edifices with marble slabs, worked into the shape of tiles. This ingenious contrivance was so highly appreciated by the Greeks, that they honoured the inventor with a statue, and with an inscription which is preserved by Pausanias. Byzes of Naxos, the author of this invention, flourished in the time of Solon, 580 years before Christ, (Pausanias, v. 10.) "The meritorious part of the invention consists in the expedients adopted for the purpose of preventing the admission of wet, and especially between the joints of the contiguous tiles: this was effected by the introduction of narrow joint-tiles, (called ἁρμοι, *harmoi*, in the Athenian inscription) extending from the ridge to the eaves in a continued line over the meeting joints of the flat tiles; these being previously ranged in courses, the higher overlapping that next in order below it." The Eleusinian Propylæa was entirely constructed of fine Pentelic marble, the pavement consisting of blocks nearly six feet square, and more than thirteen inches thick, so accurately fitted, that in many places the joint is not perceptible. There are six steps on the north front, the lower step both higher and wider than the others. Below each column a circular sinking is visible, half an inch in depth, and somewhat more in diameter than the column: a similar sinking is remarked in the steps belonging to the wings of the Propylæa at Athens, and in other Grecian edifices. It has been conjectured, that it was intended to collect the water from the channels of the flutings, and discharging it in front, but in some instances it is not open to the front of the step, and others have imagined that it was intended to mark the level to which the pavement of the portico was to be worked: however, it is met with in buildings where the pavement has been finished perfectly smooth. The columns of the north front diminish in a line very slightly convex: the bottom diameter of those at the angles is 5′ 1″,366, and at the height of 6⅓ feet from the upper step it is 4′ 11″. The beams of the ceiling are supported by the epistylia of the inner ranges of columns, and by the flank walls of the building. The beams over the side aisles were twenty-three feet long, three wide, and two and a half deep, and each weighed about eleven tons. The intervening panels were formed out of slabs four feet long, sixteen inches wide, and nine deep.

Plutarch informs us that the mystic temple of the Eleusinian Ceres was begun by Chorœbus, who proceeded so far as to erect the lower columns and their epistylia. At his death Metagenes, of Xypete, added the galleries and the upper columns: and Xenocles the Cholargian constructed the roof over the ceiling of the sanctuary. The whole area occupied by the temple was covered by a substructure of porous stone: the steps and pavement of the portico were formed of the hard grey limestone of Eleusis. The walls appeared to have been cased within and without with Eleusinian stone, the intermediate space being filled in with the same stone as that of the substructure. In advance of the Propylæa, and apparently included among the appendages of the great temple, was discovered the temple of Diana-Propylæa. Diana was considered by the Greeks as the daughter of Ceres, not of Latona, (Paus. viii. 37. Herod. ii. 156,) and hence her temple was here appropriately situated. This temple is the only variety which has yet been discovered of the species of temple called *ναος εν παραστασιν*, which presented in its fronts two columns interposed between the antæ, terminating the flank walls of the cella. It was the most simple of the forms of the early temples of Greece, and the Greek tragedian alludes to it in the dialogue between Pylades and Orestes, where the latter is instructed to obtain access to the sanctuary, and carry off the statue of the goddess, by letting himself down into the interior, where the openings between the triglyphs afforded admission. (Eurip. Iphig. in Taur. 116.) With the Doric buildings, which have been hitherto described, the roof terminates in a *stillicidium*, or dripping eaves, but in this building the sima, or upper moulding of the pediment cornice, is continued along the flanks, and a channel is hollowed in it, for the purpose of collecting the rain which fell upon the roof. (Unedited Antiquities of Attica.)

The term *propylæum*, was applied in its general meaning to the vestibule of any building, or place.

Propylon, (Gr) a vestibule.

Proscenium, the front part of the stage of the ancient theatres, on which the actors performed. It had also, or rather a part of it had the name of *pulpitum*, which the Greeks called *logeion:* for Pollux, enumerating the parts of the theatre, mentions separately the *proscenium* and the *logeion*, and Vitruvius uses the expression *proscenii pulpitum*, the pulpitum of the proscenium. The Greek name has probably been given to it, because it was the place where they spoke, λογος signifying a word, speech, or discourse; and the Latin name *pulpitum* originated perhaps in its being a place elevated, and composed of wood. (See *Pulpitum*, and *Theatre*.) The *logeion* was not more than twelve, or less than ten feet high above the floor of the orchestra. A sufficient proof that it was generally of wood, is, that in all the ruins of the theatres of the ancients, in which a part of the scene has been preserved, we do not find the least trace of the proscenium. In the theatre of Tauromenium, on which, amongst other works, may be consulted the second volume of the "Voyage Pittoresque" of M. Houel, and the "Voyage en Sicile," by Riedesel, we find before the scene, at the place where the proscenium terminates, and where the orchestra commences, a long subterraneous and vaulted gallery, which passes under the whole length of the proscenium; we arrive at the middle of this gallery by a similar gallery, which comes from above, and passes under the scene. These two galleries are disposed in the form of a T. The vault of the gallery, which passes under the proscenium in its whole length, is, at equal distances, pierced with holes, in which, without doubt, were fixed the wooden supports which formed the anterior face of the proscenium, on which were placed the timbers that formed the logeion. The theatre of Telmessus, figured in the 72nd plate of the first part of the "Voyage Pittoresque" of M. de Choiseul-Gouffier, shows evidently that the proscenium was thus supported; we there discover in the wall of the scene the openings in which the beams were fixed. Perhaps the galleries under the proscenium of the theatre of Tauromenium, served also to facilitate the access to the machines placed under the scene. In the theatre of Telmessus, we also discover in the wall, under the scene, three entrances which lead under the proscenium. According to Vitruvius, the length of the whole scene was equal to twice the diameter of the orchestra, and all the remains of ancient Roman theatres give these measures. That those who were stationed in the orchestra might not be hindered from seeing what was passing on the scene, the pulpitum in the Roman theatres must have been lower than the logeion among the Greeks. The same author accordingly tells us, that the Romans made it no more than five feet high, whilst the Greeks gave it double of that elevation.

Prostas, in Grecian houses, the passage which separated the *thalamus*, or bed-chamber, from the *antethalamus*, or antechamber.

Prostyle, temples with columns only in front. When there was also a portico at the opposite front, the temple was termed *amphiprostyle*, that is, prostyle on both sides. Such was the temple near the Ilyssus, in the environs of Athens.

Prostyride, a name given by Vignola to the key of an arcade, formed by a bunch of foliage between two listels and fillets, and crowned by a Doric cymatium.

Prothyrum, (Gr.) a porch at the outer door of a house; a rail to defend the door from horses, carts, &c.

Protractor, see *Instruments*. An improved protractor has been invented, with a moveable index fitted on the centre, and so contrived as to set off angles to a minute with great nicety.

Prytaneium, (Gr.) a place at Athens, where those who had deserved well of their country were maintained at the public charge.

Pseudisidomum, or *Pseudisodomum*: see *Isidomum*.

Pseudodipteros, (Gr.) that is, *false dipteral*, a mode of arranging the columns in a temple, in which the two fronts had eighteen columns, and the sides fifteen or sixteen. It differed from the dipteral in having only a single range of columns, the interior range near the cella being dispensed with. By this disposition, a wide gallery was left round the cella, in breadth equal to two intercolumniations and the diameter of a column. Vitruvius attributes its invention to Hermogenes. See *Hermogenes*.

Pseudoperipteros, or imperfect peripteral, a disposition of the ancient temples, in which the columns of the sides were engaged in the wall. Instead of being surrounded by a portico, it had none but on the façade in front. On each side the walls of the cella were continued to the intercolumniations of the portico, which were thereby shut. This diposition was sometimes given to temples, for the sake of enlarging the interior of the cella. Such are the temple of Fortuna Virilis at Rome, and the Maison Carrée at Nismes.

Pseudothyron, (Gr.) a false door behind a building.

Pteroma, (Gr. from *πτερον, a wing*,) the spaces between the walls of the cella of a temple, and the columns of the peristyle; called also *ambulatio*.

Pugging, a coarse kind of mortar laid on the boarding between joists.

Pug-Piling, the same as *dovetail piling*. See *Piling*.

Pulley Mortise, a long mortise, parallel to the under side of the bonding joists, for the reception of the ceiling joists.

Pulpit, (Lat.) an elevated place for public speeches; the place in a church whence the sermon is pronounced. Some of them, particularly in Roman Catholic churches, are richly ornamented.

Pulpitum, see *Logeum* and *Proscenium*.

Pulvinaria, (Lat.) cushions in the ancient temples, on which the statues of the gods were sometimes laid.

Pulvinated, (from *pulvinus*, Lat. a pillow,) a frieze that swells out in form of a pillow.

Punchion, (Fr.) a common name given to all the iron tools used by stone-cutters, &c. for cutting, or chipping: also, a piece of timber placed upright between two posts which have too much bearing: also, a piece of timber, called by Vitruvius *columen*, which is raised upright under the ridge of a building, and in which are jointed the little timbers, &c.

Punt, an oblong flat-bottomed boat, with square head and stern.

Purbeck Stone, a species of sandstone, brought from Purbeck in Dorsetshire, and much used in London, both for building and pavements. It is harsh and rough, of an ash colour, hard, and very heavy. Though it cuts to a smooth surface, it will not take a polish. It is found in other parts of the kingdom, and there are large strata of it in Yorkshire.

Purfled, (Fr.) ornamented with carving, resembling embroidery, lace-work, fringes, or flowers. An old term.

Purlins, pieces of timbers which are laid across the inside of the rafters, to keep them from sinking in the middle.

Puteal, (Lat.) The *puteal* of Libo, *puteal Libonis*, so celebrated in Roman history, was the marginal stones of a well, with a cover, which Seribonius Libo had caused to be erected by order of the senate, in a place where a thunderbolt had fallen, near the statue of Marsyas and Janus, by the Comitia. He erected within its enclosure an altar and a chapel. It appears indeed to have been a kind of tribunal, where they took cognizance of commercial affairs. The figure of this *puteal* is still seen on some medals with the inscription, PUTEAL. LIBON.

Puteoli, an ancient town of Campania, celebrated for its hot and cold springs; it is now called *Puzzuoli*. No part of the Roman port now remains, but a line of piers, which were designed to break the force of a rolling sea. The ruins of the ancient city are considerable. Among these is an amphitheatre, still almost entire, and a temple of Serapis. The latter has in great part been destroyed by volcanic commotions. It square enclosure is surrounded by buildings which appear to have served for abodes for the priests, and baths. A circular platform remains in the centre, approached by four flights of steps, on which the vases for fire, the altar, the rings for the victims, and the other appendages, still remain, although the columns which supported its roof have been removed to the palace of Caserta. The modern cathedral occupies the site of another temple, which was dedicated to the deities who were supposed to preside over commerce and navigation. Near the town are the remains of the Campanian way, which was constructed by Domitian, and frequently mentioned by Statius. It is paved with lava and lime on each side, and venerable sepulchral towers stand on each side, their interior richly stuccoed.

Putlogs, or *Putlocks*, pieces of timber about seven feet long, used in building scaffolds.

Putty, (Fr.) a kind of paste, made of whiting, a little white lead, and linseed oil, well beat together.

Puzzolana, a greyish earth used for building under water. This mineral is found in greatest abundance in the vicinity of Puteoli, and derives its name from Puzzuoli, the modern name of this place; it is also found in other parts of Italy, and generally in the neighbourhood of burning mountains, from which it has been thrown out in the form of ashes, sometimes covering the face of the country to a considerable depth, and over extensive districts: sometimes, also, found in the state of small pieces of an earthy and porous texture, classed by mineralogists under the genus lava. It is magnetic, and easily melts *per se* into a black slag. It suddenly hardens when mixed with one-third of its weight of lime and water, forming a cement more durable under water, than any other. Bergman found one hundred parts of it to contain fifty-five to sixty of siliceous earth, twenty of argillaceous, five or six of calcarious, and from fifteen to twenty of iron: this last constituent is considered to be the cause of its property of hardening under water. The iron decomposes the water of the mortar; and thus, in a very short time, a new compound is formed. This substance is found in France, and in England. Artificial puzzolana is made by reducing to a *red heat* three parts of clay, with one of slacked lime by measure. Puzzolana was called by the Romans *terra puteolana*, from the place where they chiefly procured it. The Greeks were not acquainted with this substance, and the Romans had in this respect a great advantage over them, on account of the solidity which it ensured to their buildings. When it was used in buildings in the water, they mixed, according to Vitruvius, two parts of puzzolana to one of mortar. The ruins of edifices built in the sea, in the neighbourhood of Baiæ, prove the solidity of this cement. Winckelmann, in his treatise on the architecture of the ancients, says that the Romans preferred the black puzzolana, instead of which now the preference is given to the red. Puzzolana was employed with great advantage in the construction of the public ways at Rome, and in its vicinity.

Pycnostyle, (Gr.) the method of intercolumniation, which has but a diameter and a half between each column. The *pycnostyle* intercolumniation occurs in the ruins of Palmyra.

Pylône, (Gr.) a term applied by the editors of the Description de l'Egypte, to the lofty pyramidal masses of masonry which were placed at the entrance of temples and palaces of the ancient Egyptians. They give their reasons for its adoption, in the following words: "Embarrasés de donner à ces constructions, qui n'ont point d'analogues ni dans l'architecture Grecque, ni dans l'architecture Romaine, ni dans la nôtre, une dénomination qui en présentât une idée exacte, nous avons adoptés celles de pylône, dérivée du mot grec πυλὼν, dont se servent les anciens auteurs pour désigner l'espèce d'édifice dont il est ici question."

Pyramid, (for the derivation of the word, see next article,) a solid, having one of its sides, called the *base*, a plane figure, and the other sides triangles, their points joining in one point at the top, called the *vertex*. The edge of the base and the vertex are called the two *directrices*, and the straight line extending between them is called the *generatrix*. Pyramids are called triangular, square, &c., according to the form of their bases. When the base is enclosed by a curve, the pyramid is a cone. The solidity of a pyramid may be found by multiplying the area of its base by its height, and dividing the product by three. The *frustum of a pyramid* is the lower part, when the upper part is cut off by a plane parallel to the base; the latter being also the base of the frustum. Any two edges of one end, and the corresponding edges of the other, make four proportionals. To find the solidity of the frustum of a pyramid or cone, or of a *prismoid*, which is the frustum of a wedge; to four times the area of the middle section, parallel to, and equally distant from each end, add the areas of the two ends; multiply the sum by the altitude of the solid, and one-sixth part of the product will be the solidity.

Pyramid, a building of a pyramidal form. The most ancient people raised pyramidal structures to serve for monuments. The most famous pyramids of antiquity are those of Egypt. There are at present more than forty pyramids found in that country. It is very singular, that this kind of building is only found in one district of that country, which is now called Fayoume, and which lies between Cairo and Meidun, on the west side of the Nile; hence it would appear that we ought to regard them as more modern than the temples of the Thebaid. The portion of the country, in which the pyramids are situated, is not more than twenty leagues in extent, and is situated between the twenty-ninth and thirtieth degrees of north latitude, and under the forty-ninth degree of east longitude. The pyramids mentioned by the ancients are not all now in existence; neither those which, according to Herodotus, were in the lake Mœris, nor those which, according to Herodotus, Diodorus, Pliny, and others, belonged to the labyrinth, can now be found. On the other hand, all the pyramids which now exist are not mentioned by ancient writers. It is thought that it was only one period of the Egyptian history, that was distinguished by their erection. The history of their origin, however, as given by the ancients, is very uncertain. According to Herodotus, the stones, which were used in building them, were extracted from the quarries of the eastern mountains, on the frontiers of Arabia. Yet modern travellers have observed, that the pyramids appear to be constructed of the same calcarious stone which is procured from the neighbourhood of the place where they stand.

Many opinions have been formed, as to the original destination of the Egyptian pyramids. Some, amongst whom we may include nearly all the ancients, take them for tombs. Others suppose them to have been erected for astronomical purposes, and this opinion is found in the commentary of Proclus on the Timæus of Plato. Others again have taken them for religious edifices, and suppose that in them were celebrated the most sacred mysteries. The mode of erecting these buildings was, without doubt, very simple. The first process would be to level the ground; after this they would proceed in laying different layers of stone, from the foundation to the summit, carrying up the immense stones from step to step, either by levers or some other means, with an incredible degree of industry and labour. Their design was, without doubt, to serve as sepulchres for the kings or great people, and this is the opinion of almost all the ancient writers; but they probably also partook of a religious character. M. Gatterer divides the pyramids into five groups, those near Ghizé, those near Manjelmusa, those near Sacarra, those of Dagshar, and those near Fejum. The first of these collections are the most remarkable, and are situated on a vast elevated plain, which was appropriated to the sepulchres of the inhabitants of the city of Memphis. Two pyramids, of an immense magnitude, rise far above the others, which are smaller, and in great part destroyed. Further towards the east is the great sphinx, which is cut out of a solid rock, that was found standing on the spot, but which is now in a great measure buried in sand and earth.

Several attempts have been made to ascertain the true derivation of the word *pyramid*. The Greeks all derived it from *πυρ*, *fire*; others derived it from *πυρος*, *corn*, imagining them to be the granaries that were built by Joseph, to preserve the grain of Egypt! But M. Sylvester de Sacy, in a memoire inserted in the 6th volume of the Magazine Encyclopèdique, p. 446, has shewn that the word *pyramis* belonged to the primitive language of Egypt. The Arabs call the pyramids *haram*, and in the plural *ahram*, written in the Arabic character by the three consonants *hrm*. To discover the origin of their name, M. de Sacy endeavours to discover an Egyptian or Coptic word, which might easily be made into either *pyramis* or *haram*. In conclusion, he derives it from a word composed of the three letters *h r m*, which, he observes, is found in the Oriental languages in its primitive sense, *to separate from the intercourse and usage of men*, thence in Hebrew, Syriac, &c., the verb signifies to *consecrate to God*, *to devote*; hence *herem*, a thing consecrated, and the Arabic *haram*, a thing forbidden, prohibited, a holy place; *harim*, women; *harem*, the place where they are kept separate from the men. "If before the word *haram* or *hram*, we place the Egyptian article, we shall have *pi'hram*, whence the Greeks might easily form *pyramis*, and, taking away the Egyptian article, and Greek termination, we shall have the *haram* of the Arabs. This word would signify the *holy place*, *the edifice consecrated*, *in a particular manner*, *either to some divinity*, *or to some religious use*."

Pyramids are not confined to Egypt. The pyramidal tombs of Abyssinia are described under the article *Abyssinian Buildings*: some traces of this kind of edifice have been found in other eastern countries. They occur in several instances, in the islands of the southern seas. They are found also in America, (see *Cholula*, and *Mexican Buildings*;) and their form may be traced in the pagodas of India and China. The pyramid of Meidun, near Memphis, displays the shape of the Pah-gahu temple, while that of Ghizé, if surrounded with a *tee*, would correspond precisely to that of Shoe-Madoo. Both these pyramidal forms, as well as the globular structures of the Cingalese, are alike sacred to Buddha, under different invocations or *avatars*. The variations of structure are neither accidental nor arbitrary, but imply the particular incarnation to which the edifice is dedicated.

Various authors, at different periods, have differed much in their estimates of the dimensions of the Egyptian pyramids. The following is a comparative view of the dimensions, according to several authors, of the great pyramid, in French feet.

Ancients.	Height.	Width of one of its sides.
Herodotus,	800	800
Strabo,	625	600
Diodorus Siculus	600	700
Pliny,	...	708
Moderns.		
Le Bruyn	616	704
Prosper Alpinus	625	750
Thevenot	520	682
Niebuhr,	440	710
Greaves,	444	648

Number of Layers of Stone which form it.

Greaves	207
Maillet and Thevenot	208
Pococke	212
Belon	250
Albert Liewenstein	250

In the plate *History of Arch*, we have given a figure of the entrance of the great pyramid, and, at fig Z, a sketch of the mode of roofing the interior chamber.

On the Egyptian pyramids, besides the works of the numerous travellers who have visited that country, and the authors already mentioned, may be consulted, Bellonius, de Admirabili Operum Antiquorum et Rerum Suspiciendarum præstantiâ. 4to. Paris, 1535. Greaves' Pyramidographia, or a Description of the Pyramids, 8vo. Lond. 1646. L'Egypte de Murtadi, Fils de Gaphiphe, où il est traité des Pyramides, des Débordement du Nil, et des autres Merveilles de cette Province, selon les Opinions Arabes, translated from the Arabic by P. Vatter, Par. 12mo, 1666; and English translation, 8vo. Lond. 1666; Celsius, Historia Pyramidum, 8vo.; Gochwend, Programma de Pyramidibus, folio; Krantz, Theoria Pyramidum, 8vo.; Ægyptische Merkwürdigkeiten, 8vo.; White, Ægyptiaca. Oxford, 1801.

PYRAMIDOID, (Greek,) a solid formed by the revolution of a parabola about its base, or greatest ordinate. It is also sometimes called a *parabolic spindle*.

Q.

QUADRA, a square border or frame, encompassing a basso-relievo, panel, &c.

QUADRÆ, the bands or fillets of the Ionic base, on each side of the scotia, or hollow. The term is also applied to the plinth or lower member of the podium.

QUADRANGLE, (Lat.) any figure with four angles and four sides.

QUADRANT, (Lat.) the quarter of a circle, an arc of ninety degrees with its enclosed angle.

QUADRATURE, (Lat.) the determination of the area of a figure, in a square, or even any other rectilinear form.

QUADRELS, square artificial stones, made of a dry chalky earth.

QUADRIFORES, (Lat.) folding doors whose height was divided into two; when they opened in one height, they were termed *fores valvatæ* or *valvæ*.

QUADRILATERAL, (Lat.) a figure of four sides.

QUARREL, (*carreau*, French,) a square or lozenge-shaped piece of glass for windows.

QUARRY, (*corrig*, Irish,) a place out of which stones are dug. Limestone is found in abundance in Lancashire, Westmorland, Yorkshire, and Cumberland, as well as in Devonshire, Sussex, Kent, and other of the southern counties, and Gloucestershire, Shropshire, Derbyshire, Staffordshire, and some districts of Scotland. Kent is more particularly celebrated for two kinds of stones, the *Kentish rag-stone*, of a hard strong texture, and that termed *hassock*, of a soft crumbly nature. The former is divided by the quarrymen into two kinds, the *common rag*, and the *cork stone*; the latter resembling in its general appearance strong grey lime-stone. The *hassock* is of a loose and brittle texture, crumbling between the fingers into a coarse powder resembling sand. Marble is found of various kinds in different counties. That of Sussex is much used for ornamenting chimney pieces, and many other purposes. It is chiefly found about Kirdford, and is commonly known by the name of *Petworth marble*. Excellent marble is found in various parts of Derbyshire, and several species are also found in other inland counties, as Shropshire, Nottinghamshire, &c. Near Newark, in the latter county, is found a fine blue stone, which is very nearly allied to marble, and is of great use for hearths, &c. Various species of fine marbles are found in different districts of Yorkshire, particularly on the sides of river Kent, near Kendal. A fine black marble is also found in Lancashire. It is found in abundance in several parts of Scotland, particularly on Ben Nevis, where a fine variegated species is dug up. *Chalk* quarries are chiefly found in Berk fordshire, Essex, Hertfordshire, Kent, Sussex, Surrey, and other southern counties. *Granite* is chiefly found in the northern parts of the island, although it is found plentifully in the western districts of Cornwall, and also in some other of the southern counties. *Free-stone*, is very abundant in Cheshire, Cumberland, Westmorland, Lancashire, and other northern counties. That brought from Runcorn, Manley, &c. in Cheshire, and that from Wigan, Ormskirk, Up-Holland, and the vicinity of Lancaster, are particularly celebrated. It is also abundant in Northumberland. Very fine free-stone is brought from the isle of Portland, and also from Devonshire, Cornwall, and from the Cotswold, and other quarries in Gloucestershire. A grit-stone, partaking of the nature of free-stone, is found in various districts of Shropshire, and in some other counties. In Cheshire, and in Sussex, and other southern counties is found a very useful sand-stone. In Scotland, free-stone is found in Perthshire, and many other counties. *Flag-stones*, of an excellent quality, are found at Grinsell, near Shrewsbury, at Corndon hill, near Bishop's-Castle, and about Bridgenorth, in Shropshire, as well as in the Swinney mountain, and abound in Lancashire, Yorkshire, and most of the counties which produce free-stone. The white and grey sorts of slate are found in Lancashire, Yorkshire, Westmorland, Cumberland, Northumberland, and in several districts of Scotland. The lighter and thinner kinds, as the blue, green, purple, &c. are chiefly found in Wales, and in the northern parts of Lancashire, and in some few districts of Scotland. In Borrowdale, and other parts of Westmorland and Cumberland, are found good blue and green slates. Granite, porphyry, serpentine, and other kinds of stone, are found abundantly in the isle of Jersey.

In Kent, the banks of some of the large rivers are scooped out into stone quarries in a very remarkable manner, some of them worn out and disused. Near Maidstone are many traces of quarries thus abandoned. In the quarries of Fant and Farleigh, the blocks of stone are found in irregular masses, separated by seams, and in some places buried in brick earth. Granite is often found in large detached blocks, particularly in Cornwall and Scotland, where they are easily dug up and quarried. In the Carse of Gowry in Scotland, free-stone is found in immense blocks, in the quarries of Kingoodie, some of them fifty feet long, sixteen broad, and three thick. Around Bath, numerous quarries are seen, with men at work sawing the stone into regular forms for use: the sameness of their labour, and the ghastly hue thrown over their countenances by the adhering particles, or the reflection from the stones, has a tendency to excite melancholy ideas in the beholder. Immense blocks of stone are carried down the hills, by an ingenious machine invented by Mr. Allen, of Prior Park: it is a carriage with low and broad cast-iron wheels, with a groove in the perimeter, which serves to confine their course to the pieces of wood on which they smoothly move down the hills without the help of horses, carrying from four to five tons of stone at a time, without horses: the motion regulated by a friction lever, made to bear on the hinder wheels as occasion requires.

It is highly desirable that a quarry should be situated near to some river or canal, or on the sea coast, unless it be required for building-purposes very near to the spot, as the great expense of land-carriage of many miles, in such a material, cannot be afforded. There are many instances in which canals have been cut solely for the conveyance of the stone; in others, iron and wooden rail-roads have been constructed, to lessen the labour of the draught. Some of these rail-roads being on a slightly inclined plane, the loaded carriages are impelled forward by their own gravity to considerable distances.

The implements made use of by the miners or quarrymen, although few and simple, are very efficient in their expert hands. They are represented in Plate *Tools*, and are as follow: *Fig.* 5. The sledge-hammer, or mallet. 6. The borer, or chisel. 7. Wedges. 8. The scraper. 9. The claying bar. 10. The needle. 11. The tamping bar. 12. The shovel. 13. The fusee, inserted in the charge.

In separating the different portions of stone, the readiest means are of course adopted. When the mass to be removed is not very large, and is surrounded more or less with fissures, by which it is partially unconnected with the rock, the driving in of wedges will often be sufficient to produce an entire separation. The wedges also serve to remove from their beds those portions of the rock which are already naturally separated by cracks or fissures.

Blasting, by gunpowder, is resorted to where the rock is solid and compact; and to perform the operation only two men are requisite. The miner's judgment directs him to the fittest place for the charge; and a hole is bored or cut into the hard rock to receive it, which is effected in the following manner. The borer, or chisel, *fig.* 6, is held by one man, whilst it is struck with a sledge-hammer by the other; the man holding the chisel turning it at every blow, so as to cross the previous cut, by which means the stone is chipped away by degrees. The boring, or cutting, is occasionally suspended, to clear out the hole, which is done by the scraper, *fig.* 8; then the cutting, or boring, is resumed; and so on alternately, boring and clearing out, till the perforation is of the required depth, which is from one to three feet, according to circumstances; and the diameter usually about an inch and a quarter. If the hole is wet, some tough dry clay is introduced, and the claying bar, *fig.* 9, is driven in with great violence, by which means the clay is forced into all the crevices, absorbing the moisture, and preventing the entrance of more; on withdrawing the claying bar, the hole is left dry, and of an uniform smooth surface, which adapts it for receiving the charge. The charge is generally of gunpowder alone, or mixed with quicklime, (which it is said increases the force of the explosion,) and is contained in paper as a common cartridge, to fit the bore; in very wet situations, a tin casing is used, to enclose it. The charge being now introduced, and thrust to the bottom of the hole by means of a thin, copper, tapering rod, called the needle, *fig.* 10, which is also driven down into the charge. The next operation is to exclude as much of the air as possible, by reducing the size of the vent; for which purpose, the tamping bar, *fig.* 11, is employed in ramming round the needle some yielding yet compact substance, so that when the needle is withdrawn, a very small vent or touch-hole remains. Into this perforation is dropped a fusee, or rush, charged with powder, on the top of which is fixed a *snuft*, as it is called, or some other contrivance, so adjusted as to burn a sufficient time to permit the man who fires it to retreat to a proper distance. Previous to firing it, it is usual to give notice to all persons in the immediate neighbourhood, by the blowing of a horn, that they may have the opportunity of retiring to some place of security.

The cart principally used in quarrying, is of a low, compact, and strong construction, and is made of well-seasoned wood: it is called a *quarry-cart*. The *quarry-waggon*, or *truck*, is also a low carriage, and is more particularly used in slate quarries. Its form is somewhat similar to the common barrow, having light iron wheels. A kind of inclined plane is formed in the quarry, for it to work up and down. Slates generally go through several processes in the quarrying, being separated into thin pieces.

Quarry, (Fr. *carreé*,) a pane of glass cut in a diamond or lozenge form.

Quarter-round, the same as the *Ovolo*: see *Moulding*.

Quarters, slender pieces of timber placed between the puncheons and the posts, to nail the laths to in partitions; they are four inches square, and called double quarters; or single, and four inches broad and two thick. It is an established rule, to place them fourteen inches from each other.

Quartz, (Germ.) a genus of siliceous earths, which is very common in Europe. It is more or less transparent, and is, according to M. Magellan, one of the principal kinds of stone containing metals.

Quay, (Fr.) a bank of masonry, on the side of the sea, or of a river, for the purpose of unlading goods conveniently.

Quintana, see *Castra*.

Quirk, a piece taken out of any regular ground, flat, or floor.

Quirk Mouldings, the convex part of Grecian mouldings, when they recede at the top, forming a re-enticent angle, with the surface which covers the moulding. See *Bead*.

Quoins, (Fr.) stones or other materials put in the corners of buildings, to strengthen them. See *Coin*.

R.

Rabbet, *Rabeting*, see *Rebate*.

Raddlings, an old term, the cooping or bowing-in of walls.

Radial Curves, in geometry, curves of the spiral kind, whose ordinates all terminate in the centre of the including circle, and appear like so many radii of that circle.

Radius, in geometry, the semi-diameter of a circle, or a right line drawn from the centre to the circumference; in mechanics, the spoke of a wheel.

Rafters, (Dutch,) the secondary timbers of a house, which are let into the great beam.

Raftic Coins, the same as *Rustic Coins*.

Rails. In framing, the pieces that lie horizontal are called *rails*, and those which are perpendicular *stiles*. Two rails and two stiles enclose a panel. The upper and lower part of the banister of a stair-case is called the *hand-rail*, and the *foot-rail*. Pieces of timber which lie horizontally from post to post in fences are called *rails*.

Railing, a fence composed of posts and rails.

Railway, or *Tram-road*, a track of iron, stone, &c. intended, by diminishing friction, to facilitate the conveyance of heavy loads. At first they were made only of wood, and employed only to carry coals from the pits to the warehouses, &c., but they have since been carried to a much greater extent.

The origin of rail-ways may be traced back as far as the year 1680. About this time coal came generally into use as a substitute for wood fuel in London, and other places; in consequence, the greatest inconvenience was experienced at the mines, in conveying the coals from them to the ships, and the expense of horses and machinery for the purpose was immense. To facilitate the travelling of the waggons over the roads, wooden rails or straight pieces of wood were laid down and imbedded in the road, which were afterwards improved upon by making ledges upon their sides, to prevent the waggons from going out of their track. By these simple contrivances, it was also found that a waggon, which required previously three or four horses to draw it, was with greater facility drawn by one horse, and in much less time, as the rails were laid upon a gradual descent. These wooden rail-roads had been generally in use fifty years, when cast iron was introduced as a substitute about the years 1738; but a difficulty arose in the great pressure of the heavy waggons then in use upon the iron, which was subsequently overcome, by reducing the size of the waggons, and linking a number of them together in a team, by which means the pressure was extended over a larger surface. The importance of rail-roads becoming every year more manifest, several able treatises on the subject, from distinguished scientific men, appeared towards the close of the last century, setting forth their utility, and proposing plans for their improvement. After this time, iron railroads began to be constructed as branches to canals, and in some places as roads of traffic from one place to another.

Iron railways were first used in the great foundry of Colebrook Dale, about 1786, and are said to have been projected by Mr. John Curr, civil engineer of Sheffield. Mr. Jessop was the first engineer of celebrity who made use of iron railways in the south of England. In the neghbourhood of Newcastle, and in Scotland, great use is made of iron rail-roads, as also in different parts of Wales. In Scotland, the principal rail-roads are the road from Kilmarnock to Troon, and the rail-ways of the Carron iron foundry, and of Lord Elgin's, Mr. Erskine's, and Sir J. Hope's coal mines. There have been numerous suggestions for making iron railways in the neighbourhood of Edinburgh, most of them proposed by Mr. Robert Stevenson, who has suggested a plan for crossing the narrow and deep ravines intersecting the lines of rail-road which he has proposed laying out. This plan consists in placing the waggon on a suspension frame-work. The frame-work would advance, by means of pulleys, along an inclined plane composed of chains or bars of iron extended from one side of the ravine to the other.

Rail-ways are arranged into two kinds, according to their form. The tram-ways, or plate-ways, are made of bars of cast-iron. They have a projecting edge at top, which runs along the outside of the rail; at the bottom, a rim gives the bar the strength necessary for supporting the weight of the waggon wheel, which runs flatly in the groove. The edgeways are formed of pieces of iron laid flat on the ground, and rounded on the upper side; the waggon wheel has a groove like that of a pulley, which fits to the round part of the rail-way. The tram-ways have the disadvantage of considerably augmenting the friction, in consequence of the earth, dust, sand, and gravel, which lodge in the hollow of the rail. The *edge-ways* are exempt from this inconvenience; when equal in all other respects, they are capable of bearing a more considerable weight, and consequently they are generally preferred. The edge-ways are formed of bars of wrought-iron, about an inch and a half wide; the vertical thickness, which is always greater than the width, is proportionate to the weight which the rail has to support. The edge-ways are much adopted in Wales. But in the neighbourhood of Newcastle, the tram-ways are still generally used. A third kind of iron rail-ways are quite flat, without edges or runs, and are laid into hollows made in the common road or pavement, so as not to rise above the level of the ground. This plan is particularly well adapted to the streets and squares of a town, where vehicles of all forms and sizes are continually passing.

An ingenious improvement in rail-roads, by Mr. H. R. Palmer, is described in the first volume of the first series of the Register of Arts. Instead of two lines of rail laid upon the ground, as heretofore, Mr. Palmer's rail-way consists of only one, which is elevated upon pillars, and carried in a straight line across the country, however undulating and rugged, over hills, valleys, brooks, and rivers; the pillars being longer or shorter, to suit the height of the rail above the surface of the ground, so as to preserve the line of the rail, which is always straight, whether the plane be horizontal or inclined. The waggons travel in pairs, one on each side of the rail, like paniers over the back of an ass, and they are so contrived as to need only two wheels for the pair, instead of eight.

Raiser, the upright board on the foreside of the steps of a flight of stairs.

Raising Pieces, pieces which lie under the beams, over the ports or puncheons, by the side of the house.

Raking, a term applied to mouldings whose arrises are inclined to the horizon.

Raking Temple, a member hollowed in the square of a pedestal or elsewhere.

Ramp, a concavity on the upper side of hand-railings, formed over risers, or over a half or quarter space, made by a sudden rise of the steps above.

Rampant, (Fr.) a term applied to an arch whose abutments spring from an inclined plane.

Rampart, a massy bank or elevation of earth, &c. raised for the purpose of covering a place from the direct fire of the enemy. It is made of sufficient thickness effectually to resist the impression of the cannon balls, and is formed into bastions, curtains, &c. The term *rampart* is also applied to the space left void between the wall of a city and the houses next to it, called by the Romans *pomœrium*.

Ramps, in fortification, gentle slopes made for the cannon to be drawn up and down by, and to facilitate communication, raised either on the side of an elevated work, or against a salient angle, on each side of an entering angle.

Range, a term applied to the edge of a number of bodies which run straight in the same surface or line.

Rasant *line of defence*, in fortification, that part of the courtin or flank, whence the shot exploded glances or râzes along the face of the opposite bastion.

Rath, amongst the ancient Irish, a fortress or castle. Like the British *oppidum* described by Cæsar, the *rath* was a large circular enclosure, on elevated ground, not unfrequently in the bosom of woods, and it consisted of the following parts, the *Beallagh*, *Dun*, *Mote*, *Ran*, *Rath*, *Uagh*, *&c*. The *beallagh* was an external circular enclosure, constructed of a staked hedge or fence of wood, sometimes with an entrenchment; within this enclosure resided the servants and domestic animals of the chief. The *dun*, which answered to the Norman *keep*, was situated within the area of the *beallagh*, near the centre, and was generally the habitation of the chief and his family. The *mote* or *mothan*, was the circular entrenchment which enclosed the *dun*. The *ran* was a rampart of earth or stone, surrounding the *dun*, and within the *mote*. The *rath* was the court or open area within the *ran*, wherein the *pilait* or *right lann*, (habitation of the chief and his family) was situated. They were in general small buildings of earth and hurdles, sometimes with walls of wood. The *uagh*, or *uaigh*, was the cave or cellar where the provisions were kept, and into which the women and children retired in case of danger. Although it was generally placed under the *dun*, and had steps leading from the *rath*, yet it was sometimes situated between the *dun* and the *rath* in the field. Of the ancient *Cathairs*, which were the same as the ancient *caers*, there are now no remains. At Ardscul, about three miles from Athy, is a very good specimen of a *dun*. It contains also the *amhaire* or *radhaire*, a watch-tower, which contained the habitation of the chief, and wherein guards were constantly placed. In it may be traced the foundation of a building, which consisted of two apartments, in a line with each other. The cave under the *rath* was ten feet square. When on a plain, these buildings are always circular, but on hills other forms are sometimes adopted. In a rath on the Curragh of Kildare is a tumulus, and another with a cavity. (Gough's Camden.)

Ravelin, in fortification, a flat bastion, anciently placed in the middle of a curtain. The term is now applied to a detached work, which is formed by two faces making a salient angle, and raised before the curtain of the counterscarp of a place, to cover it and the adjoining flanks from the direct fire of the enemy. It is sometimes termed a *half-moon*.

Ray, *principal*, in perspective, the perpendicular distance between the edge and the vertical point of the table.

Rebate, (*raoot*, Fr.) 1. a hard free-stone, which is used in constructing pavements: 2. a piece of wood hafted into the top of a long stick, for the purpose of beating out the mortar: 3. an iron tool sharpened something like a chisel, and employed in dressing and polishing wood.

Rebating, plaining or cutting grooves, channels, &c.

Recess, (from *recedo*, Lat.) a depth of some inches in the thickness of a wall, as a niche, &c.

Recipiangle, an instrument which was used by French engineers, to take angles in fortification, &c. It was in the form of a square, or rather a bevel, consisting of two moveable limbs like a sector; and in using it, the centre of a protractor was laid to the joint, and the degrees cut by the edge showed the quantity of the angle, or the angle made by the two rulers was traced on paper, and afterwards measured by the protractor. Sometimes a circle, marked into degrees, was annexed to it, when it could be used without a protractor. See *Bevel.*

Recta Directrix, in conic sections, a line made by the mutual intersection of the vertical plane with that of the base.

Rectangle, a figure in geometry, whose angles are all right angles. Solids are said to be *rectangular* also, with respect to their situation, as a cone, cylinder, &c. when it is perpendicular to the plane of the horizon. A parabola was called by the ancient geometers a *rectangular section of a cone*, as, before the time of Apollonius, it was considered only in a cone, the section of which by the axis would be a triangle right-angled at the vertex, hence the book of Archimedes, on the quadrature of the parabola, was entitled on "the section of a rectangular cone."

Rectification, in Geometry, the finding the length of a curve line, or a right line equal to a given curve.

Rectilinear, figures bounded by right lines.

Redans, (Fr.) projections constructed at intervals, in a wall built on uneven ground, for the purpose of preserving the same height through its whole length.

Redoubt, in fortification, a small square fort, defended only in front, used in trenches, lines of circumvallation, &c., and also to defend passages, &c. They are generally encompassed by a ditch and bank of earth, and consist of two parts, a rampart and a parapet.

Reduct, a quirk, or little piece taken out of a larger, to make it more uniform and regular.

Redundant Hyperbola, a curve of the higher kind, so called because it exceeds the conic section of that name, in the number of its hyperbolic legs, it being a triple hyperbola, with six hyperbolical legs.

Refectory, (Lat.) an eating-room. The term is confined to convents and other religious communities, and to colleges.

Reglet, (Fr.) a flat narrow moulding, used to separate from each other the parts or members of compartments and panels, and to form knots, frets, &c.

Regrating, a term given by masons to the process of taking off the outer surface of an old hewn stone, for the purpose of whitening it, and making it look fresh again.

Regula, (Lat.) a band below the tænia of the Doric epistylium.

Regular, a figure is said to be regular, when it is equilateral and equiangular. A body is regular, when it is bounded by regular and equal planes, and has all its solid angles equal.

Regular Curves, such as are the perimeters of the conic sections, which are always curved after the same geometrical manner.

Rejointing, the filling up the joints of stones in old buildings, when the mortar has been crumbled out by the effect of time and weather.

Relievo, or *relief*, the projecture of an architectural ornament.

Rendering, in building, the same as *Pagetting.*

Replum, (Lat.) the panel of the impages of a framed door.

Reredos, or *Reredosse*, (*Tarrière dos*, Fr.) a screen or division wall, placed behind an altar, rood-loft, &c. in old churches.

Reservoir, (Fr.) an artificial pond or basin, to collect water for the use of canals, mills, &c. In houses it is a basin made of wood, and lined with lead, to keep water for the supply of the house.

Belzoni describes an ancient Egyptian reservoir among the ruins of Arsinoë, at Medinet el Faium. He made an excavation, and found it to be as deep as the bottom of the Bahr Yousef; and it was, no doubt, filled at the time of the inundation, for the accommodation of the town. There are others similar in these ruins, which prove that this was the only mode they had of keeping water near them, as the river is at some distance from the town. Amongst the ruins of ancient Carthage, the reservoirs for water are still very perfect, being all arched over; they are not exposed, the walls being covered with a thick and strong cement. Amongst the remains of Forum Julii, at the modern Frejus, in France, a reservoir of water is formed by galleries in arcades, three upon the length and four upon the breadth; at the four corners, a hole through which the water entered. At Misenum, Octavius Cæsar brought water, by means of aqueducts, into immense reservoirs, the largest of which remains to this day in great preservation, and is called *piscina mirabile*: it is a subterraneous cistern, divided by alleys, formed by rows of square pillars, which support an arched roof. At Taurominium, the water was collected in a similar manner. Of its five grand reservoirs one remains perfect. These edifices were oblong squares, with arches supported by pillars. Each had an aperture for the conveyance of the water, and another to let of the superfluity, with a staircase to descend by, and a sluice to empty it entirely, and carry off the mud. Swinburne describes that reservoir which is best preserved, as divided by a row of massive pillars into two rooms, lighted by semicircular windows, near the ceiling. See *Aqueduct*.

Resistance, in mechanics, that power which acts in opposition to another, so as to diminish or destroy its effect. From the theory of resistance, there are many results which are extremely valuable when applied to practicable purposes. In the fracture of any body, as a cylinder, when it breaks by its own weight, two powers are exerted; the weight which tends to break it, and the cohesion of the parts or fibres, which resists the fracture. Now the fracture may take place in two ways. When the body is in a vertical position, the fibres of the base all break at once, and the absolute weight of the body must exceed the united resistance of all its fibres. But in an horizontal position, the fibres are broken one after another, and consequently a much less relative weight is required. From the observations of M. Mariotte, it appears that fibres may be considered as so many little bent springs, which never exert their whole force, till stretched to a certain point, and never break till entirely unbent. Those, consequently, which are nearest the axis of equilibrium, or the whole line on which the motion of the fraction will be, which is an immoveable line, are stretched less than those farther off, and therefore employ a less part of their force. Hence all bodies, fractured in this position, bend before they break. Oak will *suspend* much more than fir; but fir will support twice as much as oak; which difference is supposed to arise from the curvature of the fibres of oak. The resistance of a bar or beam to a fracture by a force which acts laterally, is as the solid made by a section of the beam in the place where the force is applied, into the distance of its centre of gravity from the point or line where the breach will end. When the beam is fixed at both ends, it must be considered as only half its length, that is, the resistance is doubled. The following is a table of the relative resistance or strengths of different bodies, resulting from the experiments of Emerson and others.

	Proportional Resistance.
Fine freestone	1
Iron	107
Brass	50
Lead	6½
Bone	22
Box, yew, plum-tree, oak	11
Elm, ash	8½
Walnut, thorn	7½
Red fir, holly, elder, plane crab-tree, apple-tree	7
Beech. cherry-tree, hazel	6⅔
Alder, asp, birch, white fir, willow	6

The following table of the cohesive force of a square inch of different substances, is from the experiments and investigations of Professor Robinson.

	Pounds.
Gold, when cast	20,000
Silver	40.000
Cast Iron 40,000 to	60,000
Wrought Iron 60,000 to	90,000
Soft Steel	12.000
Razor Steel	15,000
Oak and Beech in the direction of their fibres, from 8,000 to	17,000
Willow	12,000
Fir	8,000
Cedar	5,000
Ivory	16,000
Bone	5,000
Rope	20,000

Respond, or *Responder*, in old English architecture, a pilaster, or half-column placed against a wall, in a situation to correspond with another pilaster or pillar, so called from the Latin *respondere*, to answer.

Ressant, a term employed by William of Worcester, (Itin. 220,) in describing mouldings of doorways, supposed to have been of the ogee form.

Ressault, (Fr.) the effect of a body which projects over, or falls back from, the line or range of the other members.

Restormel Castle, see *Castle*.

Reticulatum, a kind of masonry among the Romans, in which the stones were laid diagonally. Perrault and some other writers are mistaken in supposing that the *reticulatum* was a wall constructed of stones, which had their faces in form of a parallelogram. Vitruvius prefers the reticulatum to the incertum, because it had a more regular appearance: but at the same time he observes, that it wanted solidity, because the stones were not placed horizontally.

Retrenchment, (Fr.) any thing cut off or taken from another. Any works, such as ditches, with parapets, gabions, &c. to strengthen or defend a post: and, more particularly, a simple retirade made on a horn-work or bastion, when it is intended to dispute every inch of the ground.

Return, (Fr.) the continuation of a moulding, projection, &c. in an opposite direction; a side or part which falls away from the front of a straight work.

Return Bead, one that appears both on the face and edge of a work.

Returns *of a Trench*, in fortification, the several windings and crooked lines of a trench, drawn in some measure parallel to the side of a place attacked, to prevent being enfiladed, or having the shot of the enemy scour along the length of the line. The *returns of a mine*, are the turnings and windings of a gallery.

Revels, (from the Lat. *revello*,) the two vertical sides of an aperture between the front of the wall and the window or door frame.

Revolution, the motion of a figure round an axis.

Rez-de-Chaussee, (Fr.) the ground-floor.

Rhamnus, one of the demi of Attica, celebrated for its temple of Nemesis, the remains of which are described in the "Unedited Antiquities of Attica." The *hieron* of Nemesis contained within its enclosure two temples, the principal one hexastyle peripteral, and the smaller temple *in antis*. The latter is named, by the editors of the foregoing work, the temple of Themis, from a votive chair found in it dedicated to that goddess. The temple of Nemesis is the only example of this species of temple having the antæ, which terminate the flank walls of the cella, to range with the opposite columns in the front. The lower portions of the shafts of seven columns in the south side, and one in the pronaos, remain in their original situations. A kind of railing appears to have been placed between the columns of the pronaos, as the holes sunk in the pavement for the purpose of fixing it remain. The shafts of the columns in the front were fluted only at the top and bottom. The columns of the pronaos were fluted in front, and planed behind: the flutings are nine, the planes eleven. The epistylia were continued from the antæ, across the ambulatory, to the opposite columns in the flanks. The metopæ were omitted in the frieze, but the guttæ retained in the epistylia. All the members of the cornice were painted or gilt. The temple of Themis has but one portico, and is situated almost in contact with the temple of Nemesis. The walls are of the same material as the larger temple, but the columns and other parts of the ornamental architecture are of a soft porous stone. The masonry of the walls was of that kind denominated by Vitruvius, *incertum*.

Rhodiacum, (Gr.) In the interior of that part of the house, which among the Greeks was occupied by the male portion of the family, there was a peristyle greater than that of the gynæceium, enclosed on its four sides by porticos. The open place in the middle of the peristyle was generally planted with grass and flowers. The porticos which formed the peristyle were sometimes all of the same height; at others, the columns of that which faced the south were made loftier than the rest. When the peristyle had this latter disposition, it was termed *rhodiacum*. According to the description which Vitruvius gives us of the Greek houses, there were behind these porticos different apartments all round the peristyle. The walls next to the porticos were covered on the outside with stucco. Behind the northern portico was the Cyzicene œcus, and a room for pictures; towards the east was the library, towards the west the exedræ, and towards the south was a great hall, where the master of the house took his repast with his friends. In describing the part of the Greek houses which was appropriated to the men, Vitruvius mentions neither a bed-chamber nor a common sitting-room: it appears, therefore, that the master of the house passed the day in the exedræ or in the library, and in the œcus when he had company, and that at night he retired to the apartment of his wife. From the description of the part of the house inhabited by the men, given by Vitruvius, it appears that it only contained apartments that were for pleasure, more superfluous than necessary; and the necessary and essential parts of the house appear to have made part of the gynæceium.

RHOMBOID, (Gr.) a quadrilateral figure, of which the opposite sides and opposite angles are respectively equal.

RHOMBUS, (Gr.) a quadrilateral figure whose sides are all equal, and whose opposite angles are respectively equal, two being obtuse and two acute.

RHYPAROGRAPHIA, a kind of inferior painting among the ancients, which consisted in representing common inns. The forty-third plate of the third volume of the *Pitture d'Ercolano* furnishes us with an example. Pliny and Vitruvius mention these rhyparographic paintings, with which they often adorned the walls, &c. of their houses.

RIB, (Sax.) an arched piece of timber, sustaining the plaster-work of a vault, &c.

RIBBET, the recess in a wall to receive a door or window-shutter, as it folds back when opened.

RIDEAU, in fortification, a small elevation of earth, extending lengthways, to cover a camp, or add an advantage to a post; also, a ditch, the earth of which is thrown upon its side.

RIDGE, (*hrigg*, Saxon,) the top of the roof, which rises to an acute angle.

RIGHT ANGLE an angle of ninety degrees.

RIGHT LINE, a line perfectly straight.

RIGHT CIRCLE, a circle drawn at right angles with the plane of projection.

ROADS. The Romans were peculiarly industrious in the construction of roads. The ancient Britons had many great roads running in different directions through the island; and several British roads were adopted by the Romans, and improved according to their own mode of road-making. When we remember the great number of British towns which were retained by the Romans, and fortified by them as stations or settlements, we may readily believe that many roads, now supposed to be purely Roman, were really formed in the line of previous British trackways. The Romans worked with the hand of conquest, and all but such natural obstacles as were quite superior to the efforts of human skill and labour, yielded to their perseverance; and it appears from actual investigation, that all Roman roads run invariably in a straight line, except where they meet with some *local* impediment, such as a steep mountain or a deep ravine, or where they bend out of their general direction, to approach or leave a station, or to throw off some vicinal road. (Leman on the Roman Roads, &c.; Introduction to Nichols's Hist. of Leicestershire, p. 119.) The Roman military road, in Britain, consisted of an artificial fabric, composed of chalk, pebble-stones, or gravel, raised to a considerable height above the level of the natural soil. These materials were often brought from a distant tract of country; and instances are yet to be seen, of the road rising to the height of ten feet, in a crest of emphatical but deserted grandeur. The occurrence of so great an elevation was most frequent on heaths, covered with long stubbed or pol-hard oaks; and it has been conjectured, that such was the aspect of a great part of Britain, in the early periods of the Roman ascendancy; and that the forest trees in the vicinity of a great military thoroughfare were thus decapitated for the security of an army on its march, by revealing the recesses of the surrounding country, and precluding the danger of surprise. The most considerable of the Roman ways were paved with stones: when the surface did not consist of large paving stones, it was composed of gravel, and the durability of the road was greatly assisted by excellent drains, disposed with much care and judgment. For more copious information on the construction of Roman roads, the reader is referred to Bergier's "Histoire des Grands Chemins de l'Empire Romain," &c.

Miss Knight divides Roman roads into *stratas vias*, pebbles and gravel, like ours; *vias silice stratas*, paved with large unequal stones; and *vias saxo et lapide quadrato stratas*, a kind of flagged pavements. In some roads four strata occur: (1) the *statumen*, or foundation, all sand and soft matter being carefully removed; (2) *ruderatio*, a bed of broken earthenware, tiles, &c. set in cement; (3) *nucleus*, a bed of mortar; (4) *summa crusta*, the outer coat of bricks, tiles, stones, or other materials.

Along the sides of the Roman roads, in Italy, temples, ædicula, triumphal arches, villas, groves, gardens, &c. were thrown together in the most picturesque irregularity; porticos afforded shade, and inns shelter, refreshment, or repose, to the traveller.

The Greeks commonly paved their ways with large square blocks of stones, unlike the roads of the Romans, which are composed of irregular polygons. The ancient road from Iolis to Carthæa, according to Tournefort, the finest thing of the kind, which can perhaps be found in all Greece, still exists. He traced it for three miles in extent, flanking the sides of the hills, and standing by a strong wall, of which the coping consisted of immense blocks of a greyish stone.

The British roads, before the Roman invasion, were not paved or gravelled: they were sometimes elevated terraces, and their basis was the firm and verdant turf. They are very commonly attended by tumuli or barrows, and vestiges of villages and settlements are sometimes found near them. The Romans adopted the British towns and trackways whenever they found them convenient. New Roman roads sometimes run parallel to them. The chief British trackways adopted by the Romans, are the Foss-road and Ikenild-street.

Among the old English we find roads made of mortar and stone, of wood and stone, and roads for carriages, distinguished from bridleways. The Anglo-Saxons called the old Roman roads, military ways; the British trackways, the country roads; and they distinguished the high-ways as *anes wænsgang*, (one waggon's way) which was four feet broad, and *twegna wæna ganweg*, (two waggons' way,) which was perhaps eight or more.

In Mr. Mc. Adam's observations on the arrangement of roads, he observes, "The reason we require artificial roads in Europe is, that the soil becomes soft from wetness; were the natural earth always dry, nothing could be preferable, for, being travelled upon, it would never wear out, nor would any carriage, however heavy, sink in it. The object to be aimed at, therefore, is to keep the natural soil dry, and this may be done both by defending it from ground water, and from that which falls from above. In the knowledge of the measures requisite to effect these objects, consists the whole science of road-making."

A patent was given to Mr. Parker for an improved method of paving roads. The method of paving *parts* of roads, for which this patent has been granted, consists in forming two parallel rows or lines, of hard materials, at a proper distance asunder to support the wheels of the carriages, which distance must be regulated by the medium length of their axles; thus forming a way or track for them, similar to a rail-road. Five varieties of this method are described by the patentee; the four first relating to stone rail-ways, and the fifth to a compound rail-way of stone and iron. In all the methods of making the stone ways, long blocks of granite, of a suitable breadth and depth, which latter is not particularized, (but probably need not exceed a foot either way,) are laid level in the manner before mentioned, and, where the ground is soft, must have sleepers of stone or other fit material placed beneath their joints; but when the ground is hard enough, the mode of jointing these stones (in which the difference of the four first varieties consist) will support them in their places sufficiently, without any sleepers.

ROCHESTER CASTLE, see *Castle.*

ROE-STONE, or *Oolite*, a kind of lime-stone found under chalk in various parts of England, generally separated from it by beds of sand and clay. Different strata of it are called in Northamptonshire, *Ketten stone;* in Somersetshire, the *Bath fire-stone:* and in the isle of Portland, *Portland stone.* It is one of the secondary lime-stones, and may be considered as belonging to the chalk formation. It is composed of small round globules, resembling in some measure the roes of fish.

ROLLS, in Gothic architecture, mouldings representing bent cylinders.

ROMAN ARCHITECTURE. The Romans received their first notions of architecture from the Etruscans. In true taste they were always far inferior to the Greeks, but they have the merit of bringing to perfection the ornamental part, and of having raised edifices neglected by the Greeks, such as public roads, aqueducts, cloaci, amphitheatres, and triumphal arches. Under the first kings they thought more of enlarging than of embellishing the city. Every temple built at this period was small and square, being scarcely large enough to contain the statue of the deity to whom it was dedicated. The houses, agreeably to the name given them (*tecta,*) were but miserable cabins. They were not formed into regular streets, but thrown together as chance directed. The walls were half mud, and the roofs pieces of boards; and even this was a later improvement; for in the time of Romulus, the houses were only of straw, and from thence called *culmina.* The palace of the kings was a little thatched house, which is called by Ovid and Livy a *cottage.* Any thing finer than ordinary was appropriated to the embellishment of the temples. The chief ornaments, both of the temples and the houses, were their trophies, which were trunks of trees loaded with the arms taken in war; and permission to raise these was at first given only to patricians, it having some privileges attached to it. Ancus Martius built the city and port of Ostia, at the mouth of the Tiber. Tarquinius the Elder established the grand circus; he caused the walls to be rebuilt with large hewn stones, and constructed the great cloacus, which was finished by Tarquinius the Proud, and of which the remains are still to be seen. After the expulsion of the kings, the first works for the embellishment of the city were the finishing of the capitol, which Tarquinius Superbus had begun, and the Campus Martius for the gymnastic exercises of the young Romans. In the different wars which the Romans made on their neighbours, the generals made vows of dedicating temples to the divinities whose assistance they had invoked, and the plunder of the vanquished people was in part consecrated to this purpose. However, in the time of Furius Camillus, Rome must have been very badly built, for the people wanted to leave it, and settle in the conquered city of Veii. In the war with the Gauls, the latter took the city, and burnt it; as the greater part of the temples had not suffered from the fire, and as the private habitations were but cabins, the city was rebuilt in a short time, but with so much haste that no plan was followed; the streets were made narrow and crooked, and the cloaci, which were originally under the streets, now ran under the houses and courts. Amongst the temples which the Roman generals had built in fulfilment of the vows they had made in their different expeditions, the most distinguished was that of Quirinus, built by Papirius Cursor, after the victory over the Samnites, because the first solar quadrant at Rome was affixed to it. The censor Appius Claudius made the first *via*, or paved way, and the first aqueduct, both which bore his name. The aqueduct reached from Præneste to Rome, and the Appian way led from Rome to Capua, and was afterwards continued to Brundusium. During the two first Punic wars, many temples were built at Rome, but they do not appear to have been of great extent, since for that which Fulvius Flaccus raised to equestrian fortune after the war with the Celtiberians, only half of the marble tiles were employed, which he had carried away from the temple of Juno Lacinia at Crotona, to cover it. The Roman power had now arrived at a great height; most of the rich citizens quitted the country where they had hitherto lived, and settled in the city, and from this time Rome began to be embellished. Cato built a basilica, surnamed Porcia; and Titus Sempronius built another, called Sempronia. The censors, Fulvius Flaccus and A. Postumius Albinus, contributed much to the embellishment of the city; they paved it, adorned it with porticos, enlarged the circus, and made public ways and bridges on the outside. A little before the third Punic war, Rome had no theatre: for each representation a temporary scene was erected, and the spectators ranged themselves before it in the public places. When at this time the censors Messala and Cassius wished to build a theatre, the senate, at the proposal of P. Corn. Nasica, forbade it as an undertaking which might be injurious to the people.

By degrees, as the Romans extended their conquests, they transported to Rome a great number of works of art, as paintings, statues, &c., and adorned their houses with them. Their architecture still continued in the Etruscan style, and the whole embellishment of their temples consisted in adorning them, generally without any taste, with the statues, &c., which they had carried away from the conquered countries; it was not till the time of Sulla that they began to imitate the architecture of the Greeks. Their temples were built either of brick, or of such stone as was found in the vicinity: it was only in later times that the Romans were acquainted with marble, which was brought to Rome from Greece. Metellus Macedonicus, the contemporary of Mummius the conqueror of Corinth, was the first who built at Rome a temple of marble. From this time most of the grand edifices, and particularly the temples, were built of this material, and bricks were only employed to fill up the interior of the walls, and for vaults. From this time the Romans employed Grecian architects, as before they had made use of Etruscans, and they carried away many of the columns from the buildings in Greece, to adorn their own at Rome. Thus it was that Sulla carried away the columns, &c., from the temple of Jupiter Olympius, at Athens, to embellish that of Jupiter Capitolinus. We know little of the Roman architects who had studied in Greece. In the time of Antiochus Epiphanes, there was at Athens a Roman called Cossutius, who was employed by that king in the erection of the temple of Jupiter Olympius, and who is mentioned by Vitruvius as a skilful architect. Mutius, who had the charge of the construction of the temple of Honour and Virtue, built by order of Marius, was also a Roman, and had studied the architecture of the Greeks. The two brothers Caius and Marcus Stallius, built by order of Ariobarzanes, king of Cappadocia, the odeon at Athens, which had been burnt during the siege by Sulla. From this period the city of Rome began to be embellished with fine edifices, amongst which are particularly remarked several theatres, as that of Scaurus, which was capable of holding 80,000 spectators, and that of Curio, which was moveable, and of which might be formed an amphitheatre, a kind of building unknown before. These buildings, though richly adorned, were however but temporary. Pompey erected the first theatre of stone, which might endure from one representation to another. To him and to Cæsar, Rome owes many fine monuments of architecture.

The taste for Grecian architecture influenced also the construction of private edifices, and particularly the country houses, where the rich Romans rivalled each other in splendour. The peaceable reign of Augustus was particularly favourable to the progress of architecture. He had conceived the project of making Rome the most splendid city in the world; and he was not content with himself embellishing it with a number of fine edifices, but also engaged his friends to follow his example. He built a portico, to which he gave the name of his sister Octavia, the new forum, and the temple of Mars ultor; the basilica, in honour of Caius and Lucius; the temple of Apollo, with a portico, where he established a bibliotheca or library; the mausoleum for himself and his family, was one of his most elegant buildings: he also built a theatre, which he called the theatre of Marcellus, from the name of one of his friends, who died during its erection. (See *Theatre.*) The edifices built by the companions of Augustus were, a temple of Hercules Musagetes, by Marcius Philippus; a temple of Diana, by L. Cornificius; a temple of Saturn, by Munatius Plancus; the Atrium

Libertatis, by Asinius Pollio; the temples of Concord and of Castor and Pollux, by Tiberius; a theatre, by Cornelius Balbus; and an Amphitheatre by Statilius Taurus. Agrippa distinguished himself by his grand edifices, such as aqueducts, fountains, basins, baths, &c. but more particularly by the erection of the Pantheon.

For a long time the artists of Greece and the east had been accustomed to repair to Rome, where they were esteemed and sought after. Their number was greatly increased under Augustus, but we know few of them by name. Of this number were *Cyrus*, celebrated in the time of Cicero, *Posphorus*, one of the architects of Augustus, *Saurus* and *Batrachus*, who built the temple behind the portico of Octavia, *C. Posthumius* and *L. Cocceius Ametus*, employed by Agrippa, in the environs of Naples, the latter of whom, who was a disciple of the former, made the excavation now called the grotto of Pouzzuolo, and is supposed to have built the temple at Pouzzuolo or Puteoli, which was dedicated to Augustus. Valerius, a Roman born at Ostia, was the architect of the Pantheon, and built also a theatre at Rome. Amongst the architects of this time, Vitruvius Pollio is known by his writings, the only work that has come down to us on the subject. His freedman Vitruvius Cerdon introduced the ornaments which had been improved by his master.

At the time when the Romans learnt to appreciate the architecture of the Greeks, it had already lost much of its perfection; it revived at Rome under Augustus, but it partook of the character of the time; elegance was preferred to simple and majestic beauty. Nevertheless, the exterior of buildings was not as yet overcharged with ornaments, they were rather reserved for the interior. After the burning of Rome by Nero, that emperor employed Celer and Severus to rebuild several of the edifices, and principally to raise that *golden house* which surpassed in richness all that existed in the world. Under the first successors of Augustus architecture fell into decline. It began to rise again under Vespasian and his successors, but the taste was already too much corrupted, to allow, even under the reign of Adrian, who was a great encourager of the arts, of the correction of its faults, of which one of the principal was that of wishing to surpass the great masters of former times, which they endeavoured to do by overloading their buildings with bas-reliefs and other ornaments. The principal edifice of Vespasian is his great amphitheatre, which was built nearly in the middle of the city, and which was the first stone edifice of this nature. Among the edifices that were constructed at Rome, under the emperors who succeeded him, the most distinguished are the triumphal arch of Titus, the stadium, the naumachia, the Odeon, and the forum begun by Domitian and completed by Nerva. The palace of Domitian was built for Rabirius. Frontinus had, under Nerva, the direction of the aqueducts: under Trajan flourished Apollodorus, who fell a victim to the jealousy of the prince, for blaming his architectural plans; C. Julius Lacerus built in his honour a temple in Spain. The most remarkable edifices in this reign are the forum, and the column and triumphal arch of Trajan. No emperor built more edifices than Adrian; he built the maison carrée at Nismes; in Scotland; a wall which was eighty miles long; he rebuilt Jerusalem, which he named Ælia Capitolina; and he rebuilt part of the temple of Jupiter Olympius at Athens; Detrianus was his principal architect. The edifices of this time are the villa which bore the name of the emperor, and the Ælian bridge. (See *Adrian, Adrian's Villa, Adrian's Vallum, Mausoleum,* &c.) Under the Antonines were erected the temple of Faustina and Antoninus, the column of this emperor and that of Marcus Aurelius, without reckoning numerous temples and other edifices in the provinces, and the rebuilding of Smyrna, Laodicea, and other cities of Asia Minor. After the Antonines, architecture fell with the empire into decline, as may be seen by the arch of Septimius Severus. Under Alexander Severus, the artists were encouraged, and he erected several edifices; but architecture had fallen too much, to revive: it continued to decline, till at length it became monstrous. Under the reign of Constantine the Great, many temples and Christian churches were built at Rome, which prove in an incontestable degree the bad taste of the age. The practice was now introduced, of despoiling the old edifices of their ornaments for the embellishment of the new. After Constantine had fixed the seat of the empire at Byzantium, and the people of the north had begun to threaten the empire by their excursions, architecture fell to its lowest stage, and instead of embellishing cities, the emperors thought only of building fortresses. Under Constantine, however, Metrodorus is mentioned as a skilful artist, but none of his works are known.

ROMAN ORNAMENT. In the plates *Roman Ornament* and *Roman Mosaic Pavement,* are given some of the most elegant designs that have been found among the ornaments of ancient Roman sepulchres and tesselated pavements, or Mosaics.

ROMAN ORDER, another name for the *Composite Order:* see *Order.*

ROMAN VAULTING, a term applied by some to a vault built in the following manner: each vault being built exactly as if it were single, the two vaults will meet in an edge or groin of a regular elliptical form, lying diagonally across the *compartment,* and the lines running along the top of each vault will be horizontal lines.

ROMANESQUE ARCH, see *Arch.*

ROME, a city of Italy, situated on seven hills, called, severally, Palatinus, Capitolinus, Aventinus, Janiculus, Cælius, Esquilinus, and Quirinalis. See *Roman Architecture.* Many of the principal edifices of ancient and modern Rome are described under their proper articles, as *Amphitheatre, Aqueduct, Pantheon, Peter's, St.* &c. For a fuller account, the following works may be consulted: Buonaventura, Reliquiæ Antiquæ Urbis Romanæ; Cassas, Grandes Vues Pittoresques, &c.; Percier et Fontaine, Palais, Maisons, et autres Edifices, &c. à Rome. See also Zoega, Piranesi, and Eustace, with the other travellers.

ROOD-LOFT, (*rode,* Sax. *a cross,*) a gallery between the nave and choir in churches, in front of which, towards the nave, stood the rood or cross, and images of saints. The rood-lofts of English cathedrals have often been occupied in later times by organs. At Gilden Morden, in Cambridgeshire, the rood-loft is very large and complete, having a double screen forming two pews, about six feet square, on each side of the passage to the chancel; the upper parts are of light open Gothic work, of the fifteenth century: the lower part is painted with flowers, and has figures of Edmund and Erkenwald, with their names and inscriptions.

ROOD-TOWER, or *Rood-steeple*, the building at the intersection of the nave and transept of a church, which covered the rood-loft, &c.

ROOF, (Sax.) the covering of a house, which shelters the interior from the action of the weather. The ancient roofs, according to Vitruvius, consisted of the following parts; *Trabes*, a beam or wall plate, being the timber which is laid upon the walls, columns, &c. to receive and distribute the pressure; *Culmen*, the top or ridge. *Columen*, the king post; *Transtræ*, the principal rafters; *Capreoli*, struts or braces; *Canterii*, small or common rafters, projecting to the extremities of the eaves; *Templa*, cross or longitudinal pieces, which supported the *asseres*, or laths. In Pl. *Temple*, *fig*. 13 shows a transverse section through the roof of an ancient temple, according to Vitruvius, *a*, the *trabs*, b b, the *tigna*, c c, *axis*, d, *transtrum*, e, *capreolus*, f, *columen*, g g, *canterii*, h h, *templa*, i i, *asseres*. The trabs, or beams, which were placed immediately upon the columns and antæ, were notched, in order to preserve the tigna in their positions: these incisions were termed *cubilia* by the Romans, and *opæ* by the Greeks; whence the intervals between two were called *metopæ*.

The simplest form of a roof is, when one side of the building being higher than the other, pieces of wood are laid across in the position of an inclined plane. This is called a shed-roof, or lean-to, but is only practicable, except as wings to larger ones, in such buildings as a cow-shed or a pig-sty. Rectangular buildings are, therefore, usually covered by a roof, whose vertical section is an isosceles triangle. The height, or *pitch* of the roof was formerly made in England very high, and there are some instances in which the angle contains more than sixty degrees. The roofs of the present day have generally an angle of not more than thirty degrees. High roofs are, however, the most advantageous in point of durability in our climate. In eastern countries, the roofs are generally made flat. The principal disadvantage of this form is there obviated by the regularity of the climate. When the sides of the roof of a building are all inclined, it is called a *hipped* or *hip-roof*. If the inclined sides are not carried up till they meet, but are finished in a horizontal plane, it is said to be *truncated*. When the roof of a circular building is constructed in the form of a cone, it is a *revolved roof*. If the roof of a circular or regular polygonal building is of such a form as to have its section a regular curve, it is termed a *dome*.

The chief part of a roof of the most common and simplest construction, whose sides incline each way, is a *truss*. The principle of the truss may be thus explained: two pieces of wood simply inclined to meet in the middle, with their extremities resting on the wall, would have the greatest possible tendency to thrust them out; to obviate this, a cross beam is introduced, which acts as a string to hold them together; and since, if the span be considerable, this beam is liable from its length to sink in the middle, a post is suspended from the vertex, and attached to the beam, and, from the point of intersection, two other pieces pass obliquely to the centre of the two pieces which form the exterior of the frame. The large horizontal pieces are called the beams, and they rest at each end on the *wall plates*, and any other beams above are called *collar beams*. The perpendicular piece is called the *king post*, and in large roofs there are other perpendicular pieces called *queen posts*. The inclined pieces which pass from the base of the king-post to the middle of the outside inclined pieces, are called *struts*, and these latter are termed the *principal rafters*. The piece which is parallel to the wall-plates, and supported by the ends of the tie-beams, is named the *pole-plate*. The piece which runs along the top is called the *ridge-piece*, and the piece which runs parallel to this and the pole-plate, half-way between them, is called the *purlin*. The small pieces, running parallel to the principal rafters, supported by the pole-plate and purlin, and resting in the ridge-piece at the extremity, are called *common rafters* or *spars*. The head of the king-post is formed much wider than the rest of it, and is bevelled at right angles with the inclination of the rafter, which is firmly mortised into it, the projecting parts being called *joggles*. An iron strap is sometimes added for greater security, bolted into each piece. Sometimes the king-post is mortised into the beam, and secured with pins, but the best way is to suspend it by an iron strap resembling a stirrup, which passes round the beam, and at its upper end is fixed to the king-post. *Fig. d*, (plate *Carpentry*, C. 44.) shows the mode of joining the collar beam, principal rafter, and one of the queen-posts, and the iron braces to protect the junction, as executed in the truss of the roof of Drury Lane Theatre. Our plates of roofs, represent a section of the riding-house built at Moscow, an elevation, part of the roof on a larger scale, and A, B, C, the mode of joining the parts. The other plate contains the roof of the Sheldonian theatre at Oxford, and that of the Argentine theatre at Rome.

In some roofs are used *puncheons*, or short transverse pieces of timber, fixed between two others to support them equally; *straining beams*, or pieces of timber placed between two queen-posts at their upper end, for the purpose of withstanding the thrust of the principal rafters; *straining sills*, or pieces of timber placed upon the tie-beam, at the bottom of the queen-posts, to withstand the force of the braces, which are acted upon by the weight of the covering; *chamber beams*, or horizontal pieces of timber made on the upper edge to slope from the middle towards each end in an obtuse angle, for discharging the water, and placed above the straining beam in a truncated roof, to fix the boarding on which the lead is laid; and *auxiliary rafters*, called sometimes *principal braces* and *cushion rafters*, which are pieces of timber framed in the same vertical frame with the principal rafters under them, and parallel with them.

In roofs of rectangular buildings, instead of a lead flat, a valley is often introduced, which makes the vertical section in the form of the letter M, or rather of an inverted M, when it is called an *M roof*.

The most common pitch of a roof for slates, is that whose height is one-fourth of the span, or whose inclination is at an angle of 26° 30′ with the horizon. If we take this as a standard, the following table will show the degree of inclination for other materials.

Kind of covering.	Inclination to the horizon.	Height of roof in parts of the Span.	Weight upon a square of roofing.
	deg. min.		
Copper, lead,	3 50	$\frac{1}{48}$	Copper 100 lead 700
Large slates.	22 0	$\frac{1}{5}$	1120
Com. slates,	26 33	$\frac{1}{4}$	from 500 to 900
Stone slates,	29 41	$\frac{2}{7}$	2380
Plain tiles,	29 41	$\frac{2}{7}$	1780
Pan-tiles	24 0	$\frac{2}{9}$	650
Thatch,	45 0	$\frac{1}{2}$	

A roof of an improved construction, by A. H. Holdsworth, Esq. is described in the first volume of the Register of Arts, for which the Society of Arts gave their silver medal. In this method of roofing there is a great saving of timber; and the gaining the whole space under the roof for useful purposes. A A, fig. 6, plate *Carpentry* C. xix. represents the walls of the house B, one of the timbers of the uppermost floor, resting on the sleepers *f f*, which are let into the wall; over two other sleepers laid in the top of the wall, are fitted two pieces of wood, D D. The principal rafters C C, forming each pair, are then secured at the bottom, into the pieces D D, and are fastened to each other at the top by iron pins. Each pair of the principal rafters C C, is supported by two arch pieces E E, these pieces are *in their grain*, and are formed on the plan recommended by Mr. Hokey, of the king's yard at Woolwich, to whom the country is so much indebted for this method of preparing the timber. They are cut lengthways, by a saw, into three pieces, to within two feet of one end, are then placed in a steam-kiln, and boiled until they will bend freely, when they are fixed to a mould, and left to cool; after which, a few pins of wood are driven through, to keep the pieces so cut from again flying open. The arch pieces will get a little out of shape when taken from the mould, but will be easily brought back, and, when secured under the principal rafters, will fit the more firmly. The lower end of these arch pieces are inserted in the beam B of the floor, and therein firmly pinned; while at the top they cross one another, and each butts against its opposite rafter. They are further secured, by iron straps, to the short pieces D D, on which the principal rafters rest, thus preventing the latter from sinking and thrusting out the walls, and making the whole a stiff and complete framing, on which the longitudinal rafters, and transverse pieces, are fastened in the usual manner. The most important circumstance to attend to, is that of bringing the feet of the arch pieces so far down the wall, as to give them a firm bearing. Mr. Holdsworth has used this kind of roof to buildings of great width, and expresses his entire confidence in the belief, that it may be advantageously applied to any extent of building, for which timber of sufficient length can be procured.

Both copper and iron are used for covering roofs in Sweden; the iron becomes of an equal reddish colour throughout, lasts a long time, and is very secure. The copper soon becomes of a dirty whitish green, but very unequal colour, which produces a very disagreeable effect.

The spring rafter, invented by Mr. Smart of the Ordinance wharf, Westminster bridge, received the honorary reward of the Society of Arts. For roofs nearly flat, this improved method is found highly advantageous. A square spar, of the usual size for a rafter, is cut with a circular [illegible] at *b b*, figure 7, (pl. C. xix.) it is then again cut, as represented at C, at right angles to the former cutting, and at equal distances from each end; and lastly a thin wedge is cut out of the two places marked *d d*; the two pieces *c d*, are then to be gently raised up, till they form an angle of ten or twelve degrees with the piece *b b*, and are secured to their place by the insertion of a key-wedge *e*, of seasoned oak, as represented at No. 2. It is evident that a weight pressing on the key-wedge of this rafter, (the ends being properly supported,) will be sustained till either the fibres of the wood forming the string are drawn asunder, or till the lateral cohesion forming the butt-ends of the rafters are destroyed; at the same time there is no lateral pressure on the wall, or other support. (See *Carpentry*, *Bell-roof*, *&c.*

Room, a part of a house enclosed by a wall, and entered by a door, as a kitchen, parlour, dining-room, drawing-room, chamber, &c. The proportions of rooms depend much on their use. Their length in general may be from once to twice their breadth; but they are commonly made longer, in proportion, according to their size: thus a small room may be square, while one of very large dimensions may be in length at least twice its breadth. The height may be three-fourths of the breadth, when the ceiling is flat; but when it is coved or arched, it should be once and a fourth, or more, according to the rise of the arch. The ornaments of the walls of rooms are columns, pilasters, entablatures, niches, recesses, and panels, with foliage and other embellishments. When an apartment is adorned with an entire order, the entablature may occupy one-sixth or one-seventh of the height. If a cornice, frieze, and astragal are used, they may be one-tenth. Pilasters should not project more than one-tenth, or one-eighth of their breadth; and all proportions should be much more delicate than on the exterior of the building.

Roporography, see *Arabesque.*

Rose, or *Rosette*, an ornament sculptured in the centre of each face of the abacus of the Corinthian capital.

Rose Window, a circular window, with compartments of mullions or tracery, branching from a centre; it is sometimes also called a *catherine-wheel*, or *marigold window*.

Rosslyn Chapel, in Scotland, was founded by William Saint Clair, earl of Caithness and Orkney, in 1446, and is now in a mutilated condition. It is a most remarkable specimen of architecture, and combines, according to the description of Mr. Gandy, "the Egyptian, Grecian, Roman, and Saracenic styles." Mr. Britton, in his Architectural Antiquities, observes, that "of arches, there are more than thirteen varieties to be found in this building. A flat, or segment, beneath the roof of the aisles, and over the door to the sub-chapel; semicircular in the vault of the roof, and over the entrance doors; groined, acutely pointed over the western aisles; flat-pointed between the centre and side aisles; sharp-pointed in the lower windows; ogee to the piscinas: flattened, and latest of the pointed style, inside of the doorway, south-side; half segment in the flying buttresses; counter arch in the triangular windows; flat arch and segment joined, in a door in the vault; several arches of various forms in the windows, niches, and canopies, also in the battlements." The exterior of this building is supported by twenty-one buttresses, surmounted by pinnacles, and differing in ornaments." Two have double pinnacles, the outer shafts of which are smaller than the inner, and connected by flying abutments. Even the windows that answer to one another in situation and dimensions, all differ in the tracery and other ornaments. The transom of the arch of the windows at the eastern end is decorated with half-figures of persons in a supplicating attitude.

Rostrum, (Lat.) The place where the orators pleaded at Rome. The rostrum was a kind of square pulpit, supported by columns, and ornamented with a base formed of *rostra*, or the beaks of ships, from whence it took its name. There were two rostra, termed *vetera* and *nova*. The first was placed in the forum Romanum, near the place called *curia postilia*, and was adorned with the beaks of the ships taken in the first naval victory gained over the Carthaginians. Its figure is seen on a medal of the family Lollia, in the Thesaurus Morellianus, on another of C. Junius Silanus, published by Gessner, and on several others. The *rostra nova* was als ocalled *Julia*, either because it was situated near the temple of Augustus, or because it had been the work of Julius Cæsar, or because it had been repaired by Augustus.

Rotunda, (Lat.) a building which is round both within and without.

Rough-casting, is the ordinary mode of finishing the plaster and lath outside work of cottages, and inferior buildings; a pricking-up coat of hair-mortar is first put on, upon which, when tolerably dry, a smooth coat of the same mixture is laid; and a second workman following with a vessel full of a thinner mixture, which he throws over the work as fast as it is finished: this last operation produces an uniformity of colour.

Round Churches. These constitute, Mr. Britton observes, a singular and rare class of ancient edifices, and are eminently interesting to the architectural antiquary. Their origin in England has been generally attributed to the Jews. This opinion was very prevalent with respect to that at Cambridge, till Mr. Essex, in his historical observations in the sixth volume of the Archæologia, showed its evident incorrectness. "Their temple at Jerusalem," he says, "was not of the circular form, neither was the tabernacle of Moses; nor do we find the modern Jews affect that figure in building their synagogues. It has, however, been generally supposed, that the round church at Cambridge, that at Northampton, and some others, were built for synagogues by the Jews, while they were permitted to dwell in those places; but as no probable reason can be assigned for this supposition, and I think it is very certain that the Jews who were settled in Cambridge had their synagogue, and probably dwelt together in a part of the town now called the Jewry, so we may reasonably conclude, the round churches we find in other parts of this kingdom were not built by the Jews for synagogues, whatever the places may be called in which they stand." There are four perfect examples of these buildings in England: St. Sepulchre's at Cambridge, St. Sepulchre's at Northampton, the Temple church in London, and a small church at Little Maplestead, in Essex. All these, with one that was at Temple Bruer, and one at

Aslackly, in Lincolnshire, are generally attributed to the knights templars, who obtained their organization and fame in the vicinity of the church of the Holy Sepulchre at Jerusalem. This building is said to have been erected by Helena, the mother of Constantine the Great, and we are informed that it was *rebuilt* by Charlemagne, in 813. "The east end," says Mr. Essex, "I take to be of his building, containing the semicircular tribune; but the intermediate part between it and the sepulchre is more modern, and might be rebuilt when the church was restored, in the year 1049, after it was defaced by the Saracens towards the end of the tenth century." (Archæolog. vol. vi.) Bede describes this structure as a round church, with three walls and twelve pillars, (Resurrectionis Dominicæ *rotunda* ecclesia tribus cincta parietibus, duodecim columnis. Sustentatur de Locis Sanctis, c. 2.) The circular form of this building still remains. It was revered by the knights above all earthly objects, and it was their province to protect Christian pilgrims against the Saracens: and as they were originally instituted and stationed at the church of the Holy Sepulchre, it seems extremely probable that they would imitate that structure, when they were afterwards distributed in companies over Europe, and when they had occasion to erect a new church. And it actually appears that some of them in England had both the form and name of the *Holy Sepulchre*. These churches are described in the first volume of Britton's Architectural Antiquities.

Round Towers. The round towers of Ireland have long been a subject of antiquarian dispute. Nearly seventy of them still remain, and only two are known out of Ireland, which are found at Abernethy and Brechin, in Scotland. They in general bear a great resemblance to one another, are from thirty to one hundred and thirty feet high, and from thirteen to twenty in diameter. These buildings are mentioned by Giraldus Cambrensis in 1185, and by John Lynch in 1662, who attributes them to the Danes, who entered Ireland, according to Giraldus, in 838, and says that "they were called *clock theach*, or house of the bell." They have since been treated on by Peter Walsh in 1684, by Dr. Molyneux in 1727, and more lately by Dr. Ledwich, Mr. Grose, Vallancey, and Morres.

The tower at Monasterboice, near Drogheda, is one hundred and ten feet high, and seventeen in diameter: the thickness of the wall is three feet six inches. The ancient church, which is close to it, is now in ruins. In the churchyard are two very old and curious crosses; one about eighteen feet high, covered with sculpture, is called St. Boyne's cross, and is esteemed the most ancient religious relic now in Ireland. Among the sculptures on it is an inscription in Irish characters, "in which," says Mr. Elmes, "is plainly legible the name of Muredach, who was for some time king of Ireland, and died in 534, about a hundred years before the arrival of St. Patrick in that kingdom." Tradition says that this cross was sent from Rome by the pope. The round tower at Drumiskin, in Louth, is one hundred and thirty feet high, and that of Kildare one hundred and thirty-three high, and eighteen in diameter. The walls of the latter are three and a half feet thick, and are built of fine white granite to about twelve feet from the ground. The name Kildare signifies the *wood of* [illegible], and the whole district was anciently a large forest, in the centre of which was a plain sacred to Druidical worship, now called the Curragh of Kildare. "The tower at Kilkenny," Mr. Elmes observes, "which he has measured and investigated, is evidently older than the cathedral, the south transept of which appears to have been shortened in its original building, on account of the round tower, which is within a very few feet of it."

In the first volume of the Archæologia, some ancient Irish manuscripts are cited, relating to the history of the round towers, which, it appears, "were built in the darkest times of superstition, about anno 900 or 1000. The ancient Irish MSS. relate, that these towers were used for imprisoning penitents; some other writers name them *inclusoria, et arcti inclusorii ergastula*, the prisons of narrow enclosures; particularly the MS. of the Life of Dunchad-o-Braoin, of whom it is said that he betook himself into such a prison, wherein he died anno 987. The MSS. add, that these penitents were placed in the uppermost story of the tower; where having made probation, or done penance, such a limited time, according to the heinousness of their crimes, they then were permitted to descend to the next floor; and so on, by degrees until they came to the door, which always faced the entrance of the church, where they stood to receive absolution from the clergy, and the blessings of the people."

A writer in the second volume of the Archæologia, thinks that the round towers of Ireland are decidedly Irish; and he conjectures that the two Scotch examples were perhaps built by the Irish during their incursions into Scotland. In illustration of his supposition as to their use, he adds an anecdote which he met with in a Welsh MS. of the Gwider family in North Wales, in which it appears, that so late as the year 1600, the common Welsh were so wild, that Sir John Wynn, when he went to church, was forced always to leave a watchman on an eminence, whence he could see both his house and the church: his duty was, to give notice if he saw any attack made on the former, though it was always left bolted, barred, and guarded during church-time. "This anecdote naturally hints another manifest use of these towers, as the castles in Ireland (for such every gentleman's house was) almost always stood near a church; and consequently in a country in that age (1015,) much more wild than Wales, a watchman at the top of one of these towers, remaining all church-time, must be of the greatest advantage, to give alarms to the family in their churches." "I am not," he adds, "singular in my opinion on these matters, for both earl Morton and bishop Pocock concurred with me; the latter had seen a long trumpet of iron, which was dug from the bottom of one of these towers: several such have been found in Ireland, near these buildings; some of them are exhibited in one of the plates published by this society, and others are now extant in the royal museum." Mr. Gough, in an article in the same volume, thinks that these towers were erected before the introduction of bells, to call people to church by the sound of a trumpet or horn.

The round tower at Brechin, in Scotland, consists of sixty regular courses of hewn stone, of a brighter colour than the adjoining church; it is eighty-five feet high to the cornice, whence rises a low spiral pointed roof of stone, with windows, and a vane at the top. The tower at Abernethy is seventy-five feet high, and like that at Brechin is about forty-eight feet in external circumference. On the front of the tower at Brechin are two arches, one within the other, in relief. On the point of the outermost is a crucifix, and between both, towards the middle, are figures of the Virgin Mary and St. John, the latter holding a cup with a lamb. The outer arch is adorned with knobs, and within both is a small slit or loop: at the bottom of the outer arch are two beasts couchant; one of them, by its proboscis, is evidently intended for an *elephant*. (See Smith's History of Cork; Gough, and Vallencey, and Grose's Antiquities of Ireland.)

In the county of Kilkenny are many curious Druidical remains, some of which are described in the sixteenth vol. of the Archæologia. Cromlechs are very common in Ireland. They are there called *cromleacht*, which signifies, "The stone of punishment." They are known by the Welsh under the name of *crwm lechew*, or bowing stones. The cromlech at Tobin's Town, in the county of Carlow, forms a sort of rude temple, with a porch on the west end formed by two irregular upright pillars, each eight feet high, and nine broad, terminated behind by a broad flat stone, eight feet high, and nine broad. It is covered by a large sloping stone, twenty-three feet long, eighteen broad at the front end, and six behind. On the upper surface is a large channel, from which branch a number of smaller ones. The sides are enclosed by several upright stones, forming a room or cell, eight feet wide in front, and five behind. A sort of avenue, formed by small hillocks, leads to the portico from the west. It is situated near a rivulet, on the road from Tullow to Hatchet's Town. Another remarkable cromlech occurs in a field about a mile and a half from Carlow. See, besides the books already referred to, Ware's Antiquities of Ireland.

Round Towers, attached to parish churches, occur chiefly in the counties of Norfolk and Suffolk, and are traditionally attributed to the Danes. They are uniformly constructed of rough materials, and such as could be easily procured; whole flints, stones, chalk, and other coarse ingredients, imbedded in mortar. The walls are generally of a great thickness, but gradually diminish in substance, as they ascend. They are usually found with small churches, and are not uniformly situated at the west end: at Tooting, in Surrey, a circular tower is found on the north side of the church. Why these remains are attributed to the Danes, it is not easy to say, unless from their frequent occurrence in the Danish district of East Anglia. No ancient towers of this kind are found in the northern countries whence they came. The high antiquity of these buildings must be allowed by all. The embellished pointed arch never occurs, except when evidently a modern addition. In the tower of the church of Bychamwell, Norfolk, are four pointed apertures, the arched parts of which, and the sides, are formed of plain squared stones; and the former are disposed in the form of an *acute triangle*. They appear to be coeval with the original building, and similar arches are to be seen in the ancient entrance-gateway to Rougemont Castle, at Exeter. Even the ornamented circular style is rarely apparent, although it is by no means uncommon to find their simple narrow openings, or windows, having semicircular heads. In many instances, particularly in Suffolk, these massive round towers of churches, are lighted by narrow apertures only, which resemble loops, or arrow-slits. (See the Introduction to the Beauties of England and Wales.)

Rudder, (*roeder*, Dutch,) the instrument at the stern, by which a ship is governed. The ancients sometimes had but two rudders to a vessel, and, according to Athenæus, that of Philopater had four; of these we learn from Suidas, that two were placed at the stern, and two at the prow.

Rudenture, (Fr.) the figure of a rope or staff, which is frequently used to fill up the flutings of columns, the convexity of which contrasts with the concavity of the flutings, and serves to strengthen the edges. Sometimes, instead of being in a convex shape, the flutings are filled with a flat surface, which reaches nearly to the edges, as we see in the interior columns of the Pantheon. Sometimes the rudentures are ornamentally carved, and sometimes on pilasters, &c. rudiments are used in relief, without flutings. Rudentures are the most common ornaments of the flutings in the Ionic and Corinthian orders. As their use is to give greater solidity to the lower part of the shaft, and secure the edges, they are in general only used in columns which rise from the ground, and are not to reach above one-third of their height of the shaft. The arch of Constantine offers an example of columns with rudentures one-third of their height, although raised on pedestals, but it is evident, that this arch has been built of the ruins of some other edifice, where the columns may have rested on the ground.

Ruderation, (Lat.) a mode of laying pavements, mentioned by Vitruvius, and, according to some, of building walls, with rough pebbles and mortar. The mortar was made of lime and sand, and is called by Vitruvius *statumen*.

Rule, an instrument for measuring, &c., of which there are several kinds; stone-cutter's rules, mason's rules, carpenter's rules, sliding rules, parallel rules, &c. See *Instruments*.

The carpenter's rule is called sometimes the *sliding rule*, because it has several sliding pieces, which are used in making different calculations. Its principal uses will be understood by the following examples. (1.) In multiplication, if we wish to find the produce of 12 and 14, set 1 on the slide marked B to 12 (the multiplier) on A, and against 14, (the multiplicand) on B will be found the product on A, which is 168. If the number be higher than the scale reaches, they may be taken as decimals, thus 783 may be reckoned as 78.3, and 45 as 4.5, &c. This observation applies equally to other cases. (2.) In division, if it be required to divide 180 by 12, set 12 on A to 1 on B, and against the dividend 360, on A will be found 15, the answer on B. The line marked C, contains all squares, lengths, and contents of solids, and D all roots. (3.) To square any number: let it be 15; first place 1 on C to 10 on D, and it must be observed, that when you consider the 10 on D as 10, the 1 on C will be its square, or 100, and if you reckon the 10 on D as 1, the 1 on C will also be 1, and so on: then again every number on D stands its square on C, in the same proportion; thus the square of 15 will be 225; and if you reckon it as 150, the square will be 22500, &c. (4.) To extract the square root of a number, fixing the slider as in the last example, against every number on C will be found its square root on D. (5.) To find a mean proportional between 6 and 54, set one number 6 on C, to the same number on D, and against 54 on C will be found 18 on D, which is the mean proportional.

Rural Architecture, that branch of architecture which relates to the construction of picturesque and rustic dwelling-houses, &c., in the country. In the choice of situations, for a residence of this description, attention should be particularly paid to its convenience in site and position, with regard to the adjoining country, so as at once to be in itself picturesque, and at the same time to afford picturesque views to its inmates. When the surface of the country is but gently varied, the highest eminences will be found generally the most appropriate and agreeable, but if the hills are high and numerous, their sides, or, when very steep, a gentle slope at the bottom will be the best situation. The bank of a river, or the margin of a lake, particularly when the banks are woody and diversified with rocks, will afford a good situation. In the building itself, a certain degree of irregularity is necessary; and its convenience will be greatly increased by a careful attention to the position of the rooms. Thus, for instance, the breakfast-room should be so situated as to afford a morning scene, and the drawing-room might be so disposed as to present a view of the setting-sun; and to every view some object should be visible, to form a striking characteristic. At mid-day, the prospect may be rendered agreeable, by an expanse of water, or a brook. The style of building is best regulated by the nature of the situation. In an exposed situation, where trees are generally broad and low, as on the brows of high hills, rocks, &c. the buildings should also be low, and have some appearance of strength and solidity. In low fertile plains, where trees are luxuriant, and generally grow to a considerable elevation, and their outlines generally narrow, round, and flowing, with few horizontal branches, the shoots and branches tender, and the trunks comparatively slender, the buildings may also, like them, be high, light, and elegant. More massy and splendid edifices, should be built in rich extended plains. This mode of regulating the style and situation of rural edifices, it has been observed, "is certainly deserving of attention, were it for no other reason, than that the trees might grow well with the buildings; that when full-grown they might neither be too large nor too small; that they might neither diminish it into insignificance, nor leave it staring through the trees, which, from want of due proportion to it, appear as copsewood."

Many places are more appropriated for the growth of some kinds of trees than others. This also should be particularly attended to. The most common trees are oak, elm, and beech. But in some situations, particularly on lofty ground, the only kind of trees that can be got to flourish, are larches, firs, birch, and mountain ash. The colour and hue of the surrounding objects should also be attended to—the tints of the rocks, stones, soil, or foliage; and they ought to form a guide for the colour of the edifices which are erected in their neighbourhood.

Rustic, a mode of building in imitation of nature. The ancients sometimes built with stones, smoothed only on the sides where they were intended to join, and the outer surface left entirely rough. A species of rustic employed by the Greeks is found in the base of the choragic monument of Lysicrates. But one of the noblest specimens of this kind of work, is the vast wall which surrounded the forum of Nerva, and which is now called the wall of the arch of Panthanus. Other examples are found in the aqueduct of Claudius, called also the arch of Drusus, and in the amphitheatres of Pola and Verona. The Italian architect, Bruneleschi, employed rustic work in great profusion, for the purpose of impressing all his works with a character of strength and grandeur, but later Italian architects have used it with less profusion and more taste.

Frosted Rustic Work, has the margins of the stones reduced to a plane parallel to the plane of the wall, the intermediate parts having an irregular surface.

Vermiculated Rustic Work, has these intermediate parts so worked as to have the appearance of being eaten by worms.

Rustic Chamfered work, in which the face of the stones being smoothed, and made parallel to the surface of the wall, and the angles bevelled to an angle of one hundred and thirty-five degrees with the face of the stone, when they come together on the wall, the bevelling will form an internal right angle.

Rustic Coins, (called by Vitruvius, *lapides minantes*,) stones at the interior angles of buildings, which project from the surface of the wall, the edges being bevelled, or recesses left at the joints. At present they are not much used.

Rustic Order, that kind of building, where the face of the stones are hatched or picked with the point of a hammer.

S.

Sabliere, a piece of timber as long as a beam, but not so thick. An old term.

Sacellum, (Lat.) a small chapel amongst the Romans, without a roof, sacred to the gods. Little private *sacella*, or chapels, were annexed to the Egyptian temples. Sacella, in old church architecture, were burial chapels, for the celebration of obits, and where prayers for the dead were offered up.

Sacome, (*sacoma*, Ital.) a term applied to the exact profile of a member or moulding; and given by the French to the mouldings themselves.

Sacrarium, (Lat.) a kind of family chapel in the Roman houses, differing from the *lararium* in being dedicated to one particular deity, instead of being dedicated generally to all the household gods. Cicero, in his oration against Milo, speaks of the *sacrarium* of the *Bona Dea*. The name was also given to a part of the temples where the sacred things were deposited.

Sacristy, (from *sacrista*, Lat.) a strong room attached to a church, in which sacred vestments and utensils are deposited. See *Abbey*.

Sagging, the bending of a body in the middle by its own weight, when suspended horizontally by each end.

Sagitta, (Lat. an arrow.) This

term is sometimes applied to the key-piece of an arch. Some geometers use it to signify the abscissa of a curve. In trigonometry it is the versed sine of an arc, which stands on the chord like a dart.

Sail, (*segl*, Sax.) Amongst the ancients, sails were composed either of flax, rush, broom, or leather. In the age of Homer they were all flaxen. According to Cæsar, the Venetii had sails made of the skins of beasts. Triangular sails were most commonly used in the Mediterranean. Square ones were only used in very small vessels. The Portuguese in the Indies used round sails. Sails at first were only spread in favourable winds.

Saint-Chamas, in Provence. There is here an ancient Roman bridge entire, called by the natives the *Pont Surian*. It is built in full centre between two rocks, and on a level with the road which goes from Arles to Aix. It has but one arch, which is six toises in diameter, built with large stones three feet square, and eleven toises long. Towards the Aix side the arch has a frieze, with an inscription stating that it was built by the testamentary will of a flamen of Rome and Augustus. Some Roman work, and a similar inscription, are also found in the bridge over the Charente at Saintes.

Saliant, (Fr.) projecting.

Sally, (Fr.) a projecture; the end of a piece of timber, when cut across the fibres with an interior angle, formed by two planes.

Salonica, a city of Macedonia; anciently called *Thessalonica*. In this large city, Mr. Stuart says, "we found the remains of only one building, the description of which we could flatter ourselves would interest the lovers of antient art. This is situated in the Jews' quarter; five Corinthian columns on their pedestals support an entablature, over which is an attic adorned with figures in alto-relievo; on the side next the street are a Victory, a Medea, or perhaps a Helen, with a Diadem and Sceptre, a Telephus, and a Ganymede; and next the court-yard of the Jews' house, a Bacchante dancing and playing on the flute, a Bacchus, a Bacchante crowned with vine leaves, and a Leda. It seems difficult, if not impossible, to ascertain the species of building of which this ruin once made a part; for though the figures I have specified would seem to be proper decorations for a theatre, no traces were discovered that might confirm the opinion these figures suggested; nor does the vulgar tradition of the place afford any light that may assist our inquiries." The Greeks call this edifice *Goeteia*, (*Γοητεια*, enchantment;) and the Jews who are descended from Spanish refugees settled here, and speak Spanish, call it the *Incantada*, which has a similar meaning. A ridiculous story is attached to the name, which is given by Stuart. There are also at Salonica the remains of two triumphal arches, one of which has been richly ornamented.

Saloon, (Fr.) a lofty hall, usually vaulted at the top, with two stages of windows. It is much used in the palaces of Italy, from whence it came to France and England. It is of various forms, square, round, oval, and octagonal. See *Alhambra*, for an account of Arabian *saloons*.

Salsette, an island near Bombay, containing the famous temple of Canari, very much resembling that at Elephanta. This monument has been described by Gough, and by Mr. Salt, in the Bombay Transactions. It is characterised, like that of Elephanta, by its open courts, porticos, gigantic figures, columns in rows, forming aisles in vaulted rooms forty paces wide, and a hundred long, round at the end, grottos like burial chapels, with *dugops* or cupolas in them, by way of niches to images. In the first part of this temple are two large pilasters twenty palms high, a third of which from the bottom is square, the middle part octagonal; and the upper round. There are observed in various parts numerous inscriptions.

SANCTUARY, or *Asylum*, a place privileged by a sovereign, whence such offenders or debtors, as fled to it for protection, could not forcibly be taken without sacrilege and impiety. The privilege or immunity was called *ασυλια*, by the Greeks, and the deity presiding, *θεος ασυλαιος*, (Plut. Vit. Romul. p. 22.) Some have pretended that Nimrod, on the loss of his eldest son, was the first deviser of the institution, by erecting a golden image of him in his temple and palace, to which all that resorted, though murderers, or guilty of other capital offences, should be absolved from their crimes. The history and purport of asylums or sanctuaries, is treated at length by Mr. Pegge, in the eighth volume of the Archæologia.

This *Sanctuary*, among the Jews was the most sacred and retired place in the temple, and was termed on that account the *holy of holies*: in it was deposited the ark of the covenant, and no one was permitted to enter, except the high priest, who went in once every year to make intercession for the people. In the Grecian temples, the part which answered to the sanctuary was called *Adytum*, (see this word.) In the Catholic churches, the *Sanctuary* is that part where the high altar is placed, accompanied by a rail or balustrade. See *Cella*.

SANCTUS BELL, usually portable, and rung by a monk during the more solemn part of the ceremony of the mass, as the priest repeated *sanctus*, *sanctus*, *sanctus*.

SAND, (Danish and Dutch,) a very fine kind of gravel. Sand, in building, is chiefly used as an ingredient in mortar, for which pit-sand is the best for walls and vaults, and river sand preferable for rough-casting.

SAND-STONE, a species of stone composed essentially of sandy particles, generally of quartz, sometimes mixed with felspar or particles of slate. When the substance which cements or binds these particles together is lime, the stone is termed calcarious sand-stone: sometimes it is oxide of iron mixed with alumine. There are a great number of varieties. See *Quarry*, and *Stone*.

SANGALLO, *Antonio de*, a Florentine architect, born in the fifteenth century. He was educated as a joiner, but he afterwards left this trade, and assumed the name and profession of his uncles, Giuliano and Antonio Sangallo, who were then architects of some reputation at Rome. He was entrusted with several works by Bramante, in 1512, and arose so much in repute, that in the pontificate of Leo X. he was appointed successor to his uncle Giuliano, as architect of St. Peter's, in conjunction with Raphael. He also excelled as an engineer, and was the author of the plan of the fortifications of Civita Vecchia. Among his works are enumerated the Pauline chapel, and the magnificent staircases by which the chapels of the Vatican communicate with St. Peter's. He was employed in strengthening the foundations of the Vatican, and the great columns which support the cupola of St. Peter's, and he executed a model for that cathedral, which, however, was not closely followed. Sangallo died in 1546.

Sap, (Ital.) to undermine a wall by digging a trench under it.

Saracenic Architecture, see *Arabian Architecture*.

Sarcophagus, (Gr. from *σαρξ*, *flesh*, and *φαγω*, *to eat*,) a tomb or coffin made of one stone. According to Pliny, it was originally the name of a stone found in the Troad, and which from its powerful caustic qualities was selected for the construction of tombs. It is said to have perfectly consumed the flesh of human bodies which were buried in it, in the space of forty days. From its frequent use for this purpose, the name became applied to the tomb itself. There is also another quality related of this stone, that of turning into stone any substance deposited in vessels made of it: (Theophrastus, Pliny.) — Sarcophagi were made either of stone, of marble, or of porphyry. The Greeks sometimes employed hard wood, as oak, cedar, or cypress, which were calculated to resist humidity, and occasionally terra-cotta, and even metal. The form was generally a long square, the angles sometimes rounded. The lid varies both in shape and ornament. The sarcophagi of the primitive Christians often enclosed several corpses, and were ornamented with several sets of bassi-relievi. The sarcophagi of the ancients are often most beautifully sculptured. The figures on them were either those of the deceased, and the parties connected with them, or allegorical, or mythological. Some sarcophagi have contained only an urn. The Egyptian sarcophagi are sculptured with hieroglyphics. Those of the Romans and Grecians sometimes represent sleep and death, with their legs crossed, one hand supporting the head, and the other holding a reversed torch; sometimes Mercury is seen conducting the souls, and Churon ferrying them over in his bark. Sometimes the subjects sculptured on the sarcophagi are groups of Bacchanals, the triumphs of the god after his conquests in India, and Bacchic scenes. The early Christians ornamented their sarcophagi with pious subjects from the Old and New Testaments, such as those mentioned by Gregory of Tours, and many that may be seen in published collections.

Sarrasine, in fortification, a sort of portcullis, called also a horse, which is hung with a cord over the gate of a town or fortress, and let down in case of surprise.

Sash, (*chassis*, Fr. a frame,) the wooden frame which holds the glass in windows. A patent was given in 1819, to W. Bailey, of High Holborn, London, for an invention of certain improvements in the construction of sashes, sky-lights, frames, &c. He proposes the use of iron bars, which, after rendering them red hot, he passes through grooved rollers, so as to produce rebates on the side intended to receive the glass, and any other form of moulding upon the reverse of the sash frame; the bars are then cut into convenient lengths, and fitted together, so as to form the frame of any desired dimensions. After this the glass is to be attached by putty, or any other means, to the sash frame. For such windows as are of a curved form, particularly in the Gothic style, this invention may be peculiarly applicable by the facility in bending the bars to any desired or fanciful form. In the erection of hot-houses, greenhouses, and all kinds of conservatories, this invention is particularly useful, as it combines strength, lightness, economy, and durabity. For the purpose of roofs, sheets of iron, copper, or other materials, are to be fitted into these frames, and riveted firmly together.

Saw, (*saga*, Sax. *sawe*, Dutch,) to cut wood, ivory, stone, &c. by an edge formed into regular teeth. The Greeks attributed the invention of this instrument to Dædalus, or Talus; it is found figured on the obelisks of the Egyptians. The trunks of trees were first split into planks by wedges, and Beckman thinks, that the idea of a saw was taken from a fish-bone, for which he cites Ovid (Met. viii. 244.) Cicero (pro. Aul. Cluent.) mentions an ingenious saw, by which a thief sawed out the bottom of a chest; it was "crooked on every part of the teeth, and twisted;" adunca ex omni parte dentium et tortuosa. Saw-mills by water occur in the fourteenth century, both for cutting stone and timber. They occur at Augsburg in 1322; the first erected in Holland was in 1596. One was erected in London in 1663, but opposed by the sawyers. In 1767 or 1768, one driven by wind was built at Limehouse, but destroyed by the mob; another, however, was erected. A wind saw-mill of this description occurs at Leith in Scotland some years before. Anderson (Comm. ii. 254) mentions a wind saw-mill which was erected upon the Thames by a Dutchman, in 1633, but put down, lest labourers should want employ. (See Beckman's Invent. i. 364.) The best saws are of high-tempered steel, ground bright and smooth, and the good quality of their workmanship may be known by their bending stiffly, and equally in a bow; the former showing that they have been well hammered, and the latter that they have been evenly ground.

The saw is one of the most useful of all cutting tools to the joiner, as it enables him to divide timber, of any dimensions, into pieces or bars of whatever size he may require, with scarcely any waste. Saws are of several kinds: the *ripping-saw* is used for dividing boards into several pieces, in the direction of the fibres: the *hand-saw* is employed for cross-cutting, and sawing thin pieces in the direction of the grain: the *pannel-saw* serves either for cross-cutting, or for cutting very thin boards in a longitudinal direction: the *tenon-saw*, with a thick iron back, is used for making an incision of any depth below the surface of the wood, and for cutting pieces entirely through, not exceeding the breadth of that part of the plate between, and the iron back: the *sash-saw*, and the *dovetail-saw*, are used in much the same way. To divide boards into curved pieces, a *compass-saw*, or a very narrow saw without a back, is used, and in cutting a very small hole, a saw of the same kind called a *key-hole saw*, these two have thicker plates, and coarser teeth than either the sash or dove-tail saws. The external and internal faces of the teeth of all saws, are generally formed at an angle of sixty degrees, and the front edge-teeth slope backward in a small degree, but recline from the straight line drawn from the interior angle, perpendicular to the edge in the plane of the plate, as the saw may be employed in ripping or in cross-cutting. The teeth of all saws, except turning and key-hole saws, are bent alternately on different sides, for the purpose of clearing the sides of the cut, which the saw makes in the wood.

With the intent of saving manual labour, the saw-mill has been invented, and has been brought to such a state of perfection, that, by means of this machine, wood may be cut to the thickness of writing-paper. The general principle of these machines consists of a saw drawn up and down as long as necessary, by a motion communicated to the wheel, the piece of timber to be cut into boards being advanced, by an uniform motion, to receive the strokes of the saw. The most complete saw-mill, is that erected in the government-yard at Portsmouth, and impelled by a large steam-engine, which raises the wood to its required situation on the frame, and performs all the essential functions of animal life.

Saw-pit, a pit dug in the ground for sawing timber, which is done by two men, one standing above, and the other below. The insides should be lined with boarding, or with stones or bricks, and its depth should be a little more than the height of a man.

Saxon Architecture. This term has been applied by some writers to all architecture in England and Wales, previous to the pointed Gothic style; which is characterized by round-headed doors and windows. But we take the term as applied exclusively to buildings erected in this isle under the Saxon kings; comprehending all edifices constructed between the conversion of the Saxons in 597, and the Norman conquest in 1066, with the exception of the short intervening reigns of the three Anglo-Danish kings. The few buildings which now remain, that can, by written documents, be proved to be of an age prior to the Conquest, have caused many writers to assert, that at present there is no such specimen of Anglo-Saxon architecture extant: and many have believed that their churches, which were doubtless their chief works, were low mean buildings, usually composed of timber; and that, if in rare instances they were formed of stone, they still were destitute of columns and arches, the stone-works consisting merely of upright walls. The latter opinion has now become universally discarded, and the former rests only on presumption. It is clear from the writings of Bede, that *many* churches were constructed by the Anglo-Saxons of oaken planks, or even of wattles, and thatched with reeds. Such buildings were sometimes raised in haste, and were afterwards taken down, to give place to more substantial edifices, or were included in those more permanent structures; as in the instance of a chapel on the site of the present church of St. Peter at York, which was hastily built of wood, for the purpose of baptizing Edwin, king of Northumberland, in 627. But it may be readily apprehended, that in every age, when society was thinly spread, and the resources upon which ecclesiastical architecture depended, proceeding chiefly from the bounty of individuals, many churches, not designed for a temporary purpose, would be composed of materials so ordinary and cheap. Several such are noticed by ancient writers, and it may be observed, that a church, thus rudely formed, although the date of its erection be unknown, is still remaining at Greensted, near Ongar, in Essex. There is, however, abundant evidence that churches built of stone were contemporary with such frail edifices. "At the time the Saxons were converted," Mr. Bentham observes, "the art of constructing arches and vaultings, and of supporting stone edifices by columns, was well known among them; they had many instances of such kind of buildings before them, in the churches and other public edifices erected in the time of the Romans. For notwithstanding the havoc that had been made of the christian churches by the Picts and Scots, and by the Saxons themselves, some of them were then in being. Bede mentions two in the city of Canterbury: that dedicated to St. Martin, on the east-side of the city, wherein queen Bertha performed her devotions, and which Augustin and his companions made use of, at their first coming; and the other, that which the king, after his conversion, gave to Augustin, and which he repaired and dedicated to our blessed Saviour, and made it his archiepiscopal see. Besides these two ancient Roman churches, it is likely there were others of the same age, in different parts of the kingdom, which were then repaired, and restored to their former use." (History of Ely Cathedral.) Bede and his contemporary Eddius, make frequent mention of buildings of stone, both of their own and preceding times. Eddius describes the church of Hexham, which was founded in 674, as one of the most magnificent fabrics of the age; and particularly notes "its deepness in the ground, with rooms formed of stones, admirably polished; but having, above ground, one room of many parts, supported on various columns, and on many subterraneous chapels; yet possessing a wonderful length and height of walls; and carried, by various passages winding in lines, along spiral stairs, sometimes up, sometimes down." Richard, prior of Hexham, (Ricardus Hagust.) who flourished about a century after the Conquest, when the original building was still in existence, though in a decaying state, has left us also a description of it, and both mention the "crypts and oratories subterraneous, with winding passages to them," and relates "that the walls were of immense length and height, supported on columns of squared, varied, well-polished stones, and divided into three stories;" adding, "that the walls themselves, with the capitals of those columns by which the walls were supported, as also the coved ceiling of the sanctuary, Wilfred decorated with histories, statues, and various figures, projecting in sculpture from the stone, with the grateful variety of pictures, and with the wonderful beauty of colours. He also surrounded the very body of the church, with lateral and subterraneous chapels on every side; which, with wonderful and inexplicable artifice, he separated by walls and spiral stairs, above and below. In the very stairs, and upon them, he caused to be made of stone, ways of ascent, places of landing, and a variety of windings, some up, some down, yet so artificially, that innumerable multitudes of men might be there, and stand all about the very body of the church, yet not be visible to any that were below in it." Mr. Whitaker, (Cathedral Hist. of Cornwall,) compares the subterraneous oratories and crypts of this church with those of the old St. Paul's, (see *Paul's, St.*) and of the present cathedral of Canterbury. One of the most complete Saxon churches of which we have authentic information, was that of St. Peter's at York, which was rebuilt about the middle of the eighth century, in consequence of having suffered from fire in 741, and which is described by Alcuin, in his poem, *de Pontificibus et Sanctis Eccles. Ebor.* who makes particular mention of its pillars, arches, vaulted-roofs, windows, porticos, galleries, &c., which are the characteristics of a finished building. The church of Hexham is described by Richard as having "a tower, of a round form, from which four porticos, or aisles, proceeded." From this passage, supported by other evidences, it appears most probable that towers were added by the Saxons to their churches at a very early period. (See *Church.*)

The Saxon style was doubtless but a barbarous imitation of the architecture of Rome. Bede, in describing the church of St. Peter, in the monastery of Wearmouth, which was built by the famous Benedict Biscopius in 675, imforms us that that abbot went over to France, to engage workmen to build his church after the Roman manner. And Dr. Milner, in his Ecclesiastical Architecture of the Middle Ages, observes, that "the well-known Saxon mouldings, the chevron or zig-zag, the billet, the cable, the embattled fret, the lozenge, the corbel table, and a variety of such other ornaments as are supposed to be peculiar to Saxon architecture, will be found, on close examination, to have had their archetypes in some or other of the buildings, medals, tessellated pavements, or sepulchres of Italy, before they were adopted by our ancestors." However, it was but an imitation, for the architect of the most splendid sacred structures are to be found in native ecclesiastics.

Although the Saxon churches were in a great many instances re-edified by the Normans, yet it is allowed to be far from improbable that some few churches constructed by the Anglo-Saxons, in recluse situations, may still be in existence; and it may be presumed almost with certainty, that many *parts* of Anglo-Saxon structures still exist, though intermixed with predominating buildings, often of a much later erection. In such cases, they are most commonly to be looked for in door-ways, or in massy pillars, which sometimes support arches of another style, and in the foundations and crypts. Enriched door-cases of stone, with all the peculiarities attributed to this style, are frequently seen inserted in the buildings of churches, which, in almost every other part, or perhaps entirely, are of the Gothic or pointed style. Some motive of peculiar reverence seems to have influenced the architects of the more modern structures, in retaining these vestiges of the ancient buildings. It is conjectured by Mr. Stavely (Hist. of Churches) that the south door was sometimes the place where civil business was transacted, and Eadmer, describing the cathedral church of Canterbury, says, that "of two towers at the middle of the length of this cathedral, one on the *south* had on its side the principal door of the church; which door is often mentioned by name in the laws of our ancient kings; by which laws it is decreed, that even all suits of the whole realm, which cannot be legally determined in hundred or county courts, or certainly decided in the king's own court, must have their determination here, as in the highest court of the king." (Whitaker, Cath. Hist.) Smaller courts appear also to have been sometimes held at the doors of country churches. The preservation of circular arched doorways in more modern buildings is not confined to this country; an old door, with a round arch, and hatched mouldings, is remaining in the cathedral of Liege, although the other parts of the structure are entirely Gothic. (Ornaments of Churches considered, p. 91.)

We know from historical testimonies, that a great number of parish churches were erected between the conversion of the Saxons and the incursion of the Danes in the eighth and ninth centuries, and in a great council held at *Cealchythe*, in 816, a canon was framed, prescribing a precise manner of consecrating them by the bishop of the diocese, and directing that the saint to whom each church or altar was dedicated, should be depicted either on the wall of the oratory, or on a table.

In the church of Kirkdale, in Rydale, in the north riding of Yorkshire, over the south door is a curious inscription in Saxon characters, of which a plate is given in the fifth vol. of the Archæologia. The inscription is accompanied by an ancient dial, and is placed over a doorway, with a plain semicircular arch. It is engraved on one entire freestone, seven feet five inches long, and one foot ten inches high, and is in perfect preservation, except a small part in the centre, where the inscription is disfigured, but not obliterated by the weather. This seems in some measure to be owing to its being defended by the porch which entirely covers it, except at two angles, and consequently must have been of later erection, which is further improved by its having been formerly plastered over with lime or some other cement, as appears by the remains of it in the interstices of the letters, and in the vacancy where the hand of the dial has been broken off. The inscription may be read thus: ORM. GAMAL. SUNA. BOHTE. SANCTUS. GREGORIUS. MINSTER. THONNE. HIT. WES. ÆL. TO. BROCAN. AND. TO. FALAN. CHEHITLE. AND. MAN NEWAN. FROM. GRUNDE. CHRISTE. AND. SANCTUS. GREGORIUS. IN. EADWARD. DAGUM. CNG. IN. TOSTI. DAGUM. EARL. "Orm, Gamal's son, bought St. Gregory's church, then it was all gone to ruin and fallen down. Chehitle and others renewed it from the ground, to Christ and St. Gregory, in Eadward's days the king, and in Tosti's days the earl;" and under the dial, AND. HAWARTH. ME. WROHT. AND. BRAND. PRS. "and Hawarth me made, and Brand the priest." "That part of the inscription," observes the writer, "which is above, and runs round the radii of the dial, being somewhat defaced, I dare offer no explanation of, but am favoured with the following ingenious conjectures from the Rev. Mr. Manning of Godalming. It is obvious, says that great master of Saxon literature, from the position of this dial, that it was intended for a direct south dial, described on the plane of the prime vertical; on the back part, or north side of which, the sun never shines from the autumnal to the vernal equinox. Now such a dial may, with great propriety, be called a dial for the winter half of the year; because it exhibits the whole of the sun's diurnal course, while he is in the southern or winter half of the ecliptic, but not when he is in the northern or summer half of it." This being premised, he has no doubt that the Saxon legend was a description of such a dial, and in its original state ran thus: THIS. IS. DÆGES. SÆL. MERCA. TO. SUNNA. TILLUM. WINTERES. "This is a draught exhibiting the time of day, while the sun is passing to and from the winter-solstice." The time when this inscription was engraved may be determined within a few years. Tosti, who was fourth son of Godwin, earl of Kent, and brother to king Harold, was made earl of Northumberland, by Edward the Confessor, in 1056, on the death of earl Leward. This earl was driven from his earldom for his oppression, and was killed at Stamford bridge, near York, in 1066. The inscription must, therefore, be dated between those years. From Doomsday Book, it appears that Orm was the owner of Kirkdale, and the districts adjacent, in Edward the Confessor's time. And from Simeon of Durham, we learn that a certain Thane in Yorkshire, by name Orm, the son of Gamal, married Ethelrith, one of the five daughters of Aldred, earl of Northumberland, &c.

On one of the walls of the church of Aldborough, in Yorkshire, is the following Saxon inscription, "Ulf hit aræran cyrice for Hanum and for Gunthard saula;" *i. e.* "Ulf commanded this church to be erected for the souls of Hanum and Gunthard." From many circumstances, this church is evidently the original Anglo-Saxon structure, with a few modern additions, as pointed windows, &c. "The walls in general are made of round pebble-stones, supposed to have been gathered from the sea-shore in the neighbourhood, which kind of stones by a strong cement made very durable buildings; but the lower part of the south wall of the chancel is built with hewn stone, such as was generally used in our most ancient cathedral churches, upon which there are some grotesque figures, and in the north wall is a narrow window, about five feet high: the chancel door also, which is a south entrance, is low and narrow, and has over it an elliptic arch, ornamented with zigzag work. Ulf, who is mentioned in the inscription as its founder, was lord of the whole of this part of the Saxon province of Deira, or the country bounded by the Humber and the Tees, about the time of Canute, (Archæolog. vol. vi. p. 40, 41.)

The church of Stewkley, in Buckinghamshire, bears many marks of great antiquity, and the character of its architecture offers great inducement to suppose it Anglo-Saxon. Dr. Stukeley says, it is of an age "undoubtedly before the Conquest," and a stone is said to have been discovered in repairing the roof, bearing date 1006, (Britton, Architect. Antiq. vol. ii.) St. Peter's church, at Northampton, in the style of its ornaments bears great resemblance to it.

The observations of Mr. Garbett are entitled to particular notice. Having been appointed by the Dean and Chapter of Winchester, to superintend the repairs of the cathedral, he inferred from his own observations, that it contains portions of Saxon workmanship, of a very early age. He even concludes, that "the crypt, under the part of the church between the high altar and the Virgin chapel, is a remnant of the work of our pious British or Roman ancestors, in the early part of the fourth century." He judges that the transept contains some portions of the structure raised by Kenewalch, king of Wessex, in the seventh century, and also more of that attributed to bishop Ethelwold, in the tenth. These conclusions he draws chiefly from a comparison of the architecture and workmanship of the tower, built by bishop Walkelyn, in 1079, with part of the transept, in which, he says, "it is not difficult to trace distinctly the junction of the Norman with the

Saxon work, not only by the superiority of the masonry, but by the shape of the arches." To this supposition Mr. Britton opposes the authority of Rudborne, the historian of Winchester, that bishop Walkelyn commenced the rebuilding of the cathedral from its foundation, *(a fundamentis, capit re-adificare ecclesiam :)* but some allowance must be made for this assertion, and his beginning from the foundation need not imply that he allowed no portion of the older masonry to remain.

"There are considerable remains of one building yet standing, though now principally confined to vaults and cellaring, which may be justly attributed to the Saxon era, since there can be no doubt that they once formed a part of the monastic edifices of Westminster Abbey, probably the church, which was rebuilt by Edward the Confessor, in the latter years of his life. These remains compose the east side of the dark and principal cloisters, and range from the college dormitory on the south to the chapter-house on the north. The most curious part is the vaulted chamber, opening from the principal cloister, in which the standards for the *trials of the Pix* are kept, under the keys of the chancellor of the exchequer, and other officers of the crown. The vaulting is supported by plain groins, and semicircular arches, which rest on a massive central column, having an abacus moulding, and a square impost capital, irregularly fluted. In their original state, these remains, which are now subdivided by several cross walls, forming store-cellars, &c. appear to have composed only one apartment, about one hundred and ten feet in length, and thirty feet in breadth, the semicircular arches of which were partly sustained by a middle row of eight short and massive columns, with square capitals diversified by a difference in the sculptured ornaments. These ancient vestiges now form the basement story of the college school, and of a part of the dean and chapter's library." Britton, Architect. Antiq. vol. v.; Brayley's Hist. and Antiq. of Westminster Abbey, vol. ii.

That the church at Brixworth in Northamptonshire, is of an age anterior to the Conquest, we have many proofs. Mr. Britton judges it to be even a building of the time when the Romans were in possession of the island, after the Britons were converted. It is evident from Domesday Book, that it was in existence at that time, and in Leland's Collectanea, we may trace it to the time of Cuthbald, the second abbot of Medeshamsted, afterwards called Peterborough, who was contemporary with Wulphere, king of Mercia, who died in 670. The building is almost entirely formed of Roman bricks. This edifice has been described by Mr. Baker, in his History of Northamptonshire, and by Mr. Rickman, in his "Attempt," &c. It has at its western end, in addition to the square tower, a round one, containing a newel staircase. In its original form it appears to have consisted of a spacious nave and narrow aisles, a large chancel, and a western tower, with a clerestery to the nave, and the chancel divided from it by a large arch. The construction of this church is particularly curious; the walls being mostly built with rough red-stone rag, in pieces not much larger than common brick, and all the arches turned, and most of them covered with courses of bricks or tiles, as they may be called. The original doors and windows have all round arches, but many additions have been made in more recent ages. *Fig.* 3. Pl. *Castle*, C. 71, represents the arches which look from the tower into the church. The tower of Earl's Barton Church, in Northamptonshire, as well as that of Barton-upon-Humber, in Lincolnshire, bear marks of great antiquity, and are ascribed by Mr. Britton to the Anglo-Saxons. Both are evidently much older than the church to which they belong, which are good specimens of the Norman style. "Nothing," Mr. Britton observes, "can be found more resembling the towers now under notice, than the architectural drawings in certain manuscripts of acknowledged Saxon origin. In the British Museum, and in the Gregorian gospels preserved in the library of Salisbury cathedral, are drawings by Anglo-Saxon scribes, in which the triangular arch, and columns resembling balusters with two or three bands, are represented, and seem to be rude delineations of architectural members, very similar to those in the towers of the two Bartons, and Barneck, in Northamptonshire, in which they are employed." The walls of the tower of Earl's Barton, are partly composed of stone ribs, placed perpendicularly, with some turned as blank arches, and others fixed diagonally, whilst the intermediate spaces are formed with small rubble stones and mortar. The window openings are very small. The western doorway, which is equally rude in design and in construction, is formed of two large pieces of stone, for the jambs, imposts with slightly hollowed arches for ornament, and large masses of irregularly sized stones for the arch. The walls of the tower of St. Peter's church, at Barton upon Humber, are strongly built of rubble-stone and grout, interspersed by a sort of frame-work, formed of coarse freestone, of the same grit as the doors and windows are cased with. The uppermost story seems to be of more modern construction than the lower parts. The lower window of the south side consists of two openings, separated by a circular pillar swelling in thickness in the middle. The churches of Brixworth, Barton on Humber, Earl's Barton, Brigstock, and Barneck, may all be safely attributed to the Saxons: "They must be seen," says Mr. Rickman, "to be properly appreciated; for to do justice to them in words, would require a volume to each." *Fig.* 4, Pl. C. 71, is a sketch of triangular arches in Earl's Barton tower, and *fig.* 7, arches and columns, the latter of the same description as *fig.* 3. *Figs.* 8, 9, are triangular arches from the tower of Barneck. *Figs.* 10, 11, column and capitals from the very ancient crypt at Lastingham, or Lestingeham, in the north riding of Yorkshire. *Fig.* 13, from the tower of St. Alban's Abbey church, displays two semicircular arches, under another constructed with Roman bricks, and devoid of mouldings. A plan of the Saxon church at Brixworth is given in plate *Carpentry*, C. 42, *fig.* 4. The church of St. James, at Dunwich, in Suffolk, of which a plan is given in the twelfth volume of the Archæologia, bears in its form a great resemblance to that of Brixworth. The church of Melbourne, in Derbyshire, is supposed to be a Saxon church by Mr. Wilkins, who has given a description of it in the Archæologia, (vol. xiii. p. 290, &c.) In the old German churches, the east end is almost always semicircular. At the church of St. Margaret's Cliff, in Kent, there is a very singular doorway, of which a figure is given in the fourth vol. of King's Munimenta Antiqua. In this gate the circular arches, with their mouldings, are enclosed in a triangle. Some of the columns in arches from the tower at St. Albans, resemble those of Earl's Barton, in their singular form, with swellings, bands, &c. (King's Munimenta Antiqua, vol. 4.) The church of Saxham, in Suffolk, near Bury St. Edmund's, has a round tower, with arches, even in the highest part, which are undoubtedly either Saxon, or very early Norman. Round towers certainly are not characteristic of the Norman style, and there is, therefore, a great presumption, that the tower and its architecture are purely Saxon. Rumsey church is evidently Saxon; (Archæolog. vol. xv.) the capital of one of its pillars is given in Carter's Specimens of Ancient Sculpture and Painting. Waltham Abbey church is by the generality of antiquarians considered to be Saxon. But Britton thinks both this and Durham cathedral to be entirely Norman.

There are remains of a curious building at Warnford, in Southamptonshire, which are supposed by Mr. Wyndham, (and his supposition is ably supported,) to be the original church founded there by Wilfred. His description of it, with plates, is given in the Archæologia, (vol. v. p. 357—366.) The walls are raised with flints, bedded in a strong cement of mortar, and are of a great thickness. The arches are all semicircular and plain, and the columns which remain are round, rather slender in proportion, and not in the least resembling any of Norman construction.

The doubts and uncertainty with which the architectural monuments supposed to belong to the Anglo-Saxons are involved, make it next to impossible to give any certain traits that may be considered as distinguishing the Saxon style. Several characteristics, however, have already been mentioned, that are considered as being decidedly Anglo-Saxon, as columns, arches, &c.

Dr. Milner asserts, that Saxon buildings may in a great measure be distinguished by "the coarseness of the work."

Mr. Wilkins observes, that "the Saxons supported their arches, which separated the aisles, by a single column, or rather pier, which was circular, octangular, or hexangular, in the plan; whereas the Norman architects supported theirs, in general, with extremely massive piers, ornamented on their sides and angles with upright small columns; and sometimes they intermixed them with round piers, like the Saxons, as may be seen in Ely, Norwich, Peterborough, and other cathedrals. They differed widely, however, from the Roman proportions; and the Normans increased the difference, as is shewn by the following comparison:

Saxon Proportions.

	Diam.		*Height.*		
	ft.	*in.*	*ft.*	*in.*	*diam.*
Piers to the chancel at Orford, in Suffolk . . .	3	3	13	0	= 4
Width of the arches three diameters . . .					
Piers to the conventual church at Ely	2	4	14	2	= 6+2
Width of the arches three diameters,					

Norman Proportions.

Piers in Norwich Cathedral . .	7	3	14	6	= 2
Width of the arches two diameters . . .					

The same proportions may be observed in Ely, Peterborough, and other Norman buildings." (Archæolog. vol. xii.)

The arches, Mr. Millers (Description of Ely) observes, are "frequently very plain, sometimes decorated with various sorts of mouldings, not only on the face, but in the sofit, which, in some instances (as in the ruins at Ely,) is entirely occupied by them; double, triple, or quadruple, each resting on two columns, and generally faced with a different moulding, which is frequently double; so that, upon the whole, there are six or eight concentric circles of them; and, as each semicircle projects somewhat beyond the next, a moulding is placed under the projecting parts, usually the same as that upon the face of it."

In plate *Tools*, we have given figures of all the Saxon mouldings from Mr. King. Their names are:

1. Double leaf moulding (from Malmsbury.)
2. Chevron or zigzag.
3. Triple indented moulding.
4. Triangular frette moulding.
5. Enriched triangular moulding.
6. Embattled frette moulding.
7. Labyrinth moulding.
8. Lozenge or losange moulding.
9. Enriched lozenge, or enriched frette moulding.
10 Rose moulding.
11. Trefoil leaf mouldings.
12. Scroll foliage moulding.
13. Enriched quatrefoil moulding.
14. Mere scroll moulding.
15. Starry moulding.
16. Bead moulding.
17. Nobbed moulding.
18. Nail-head moulding.
19. Billet moulding.
20. Double billet moulding.
21. Square billet moulding.
22. Hatched moulding.
23. Incrusted moulding.
24. Scribbled moulding.
25. Cable or twisted moulding.
26. Braided moulding.
27. Crossed circle moulding.
28. Sun-flower moulding.
29. Reticulated moulding.
30. Chequer moulding.
31. Cross-pointed moulding
32. Spear-point moulding.
33. Head moulding.
34. Heart moulding.
35. Wedge moulding.
36. Nebule moulding.
37. Overlapping moulding.
38. Corbel table.

The lozenges have sometimes their ends inserted within each other like the links of a chain, as in a gate at Malmsbury, when they are termed *lozenge chain moulding*. The head moulding admits of an immense variety. Zigzag and triple indented, with a very few others, were imitated by the Normans.

The zigzag ornament is very common among the ruins of Mycenæ, and most ancient Greek cities. The following is a list of the principal buildings in which remains of Anglo-Saxon architecture are considered by different writers to be found. Avington church, Berks; Stewkly church, Bucks; Dinton church, Bucks; remains of the conventual church at Ely; Warwick church, near Carlisle; Melbourne church, Derbyshire; Studland church, Dorset; Waltham abbey church, Essex; Greensted church, Essex; church at Tewkesbury, Gloucestershire; Bishop's Cleeve church, Gloucestershire; part of Rumsey church, Hants; parts of the abbey church, and the church of St. Michael, at St. Alban's; Barfriston church, Kent; the undercroft of Canterbury cathedral; remains of the west front of St. Augustine's abbey church, Canterbury; Crowle church, Lincolnshire; Southwall church, Nottinghamshire; parts of the cathedral, and of St. Peter's in the east, Oxford; Iffley church, Oxfordshire; Teckencote church, Rutland; part of Halesowen church, and St. Kenellin's chapel, Salop; Tutbury church, Stafford; chapel at Oxford, Suffolk; New Shoreham church, Sussex; parts of the monastery at Pershore, Worcestershire; the undercroft of Worcester cathedral; the chapel of St. Mary, *in cryptis*, in York cathedral; Adel church, near Leeds, Yorkshire; and the crypt of Lestingham church, Yorkshire.

The following works are the principal authorities relating to the antiquities of the Anglo-Saxons: Gale, Quindecim Scriptores; Twysden, Decem Scriptores; Wilkins' Concilia; Ricard. Hagulstad. de Stat. Eccles; William of Malmsbury; Eddius; Scriptores post Bedam; Anglia Sacra; Brompton's Chronicon.

Scabellum, (Lat.) a kind of pedestal, anciently used to support bustos or relievos, very high and slender, generally ending in a kind of sheath, or in the way of a baluster.

Scaffold, (*eschafaut*, Fr.) a frame of wood fixed to walls, for masons, plasterers, &c. to stand on while working the parts of a building which they could not otherwise reach.

In an illuminated bible of the fifteenth century, is a representation of a scaffold round the tower of a castle, which is not like ours in stages, but ascends spirally.

A very ingenious scaffold for reparing domes was contrived by Mr. Hughes, and the invention was rewarded by the Society for the Encouragement of Arts, &c. It is made to move round on an upright pole, in the centre of the dome, and on two wheels running on the floor, so that it can readily be turned to any part of the dome. See *Constructive Carpentry*.

Scagliola, (Ital.) is the name of a species of plaster or stucco, invented in the town of Carpi, in Modena, in 1584, by Guido del Conte, composed of selenites calcined to a fine powder, and mixed with a sufficient quantity of water make a paste, which must be well kneaded. It is used in the formation of columns and ornamental works in imitation of marble; which is performed with astonishing effect. In forming columns, a frame or cradle is made of slips of wood, about two inches and a half in diameter less than it is intended to be when finished. This cradle is then lathed round, and covered with a rough coat of lime and hair, raised up in little projections. When this is quite dry, the artist lays on the composition, which is made to imitate the most beautiful and costly marbles, and which when dry receives a high polish, and proves so complete a deception, that nothing but a fracture of its substance can discover the difference. The purest gypsum is calcined and passed through a fine sieve, and, as it is wanted, mixed with a solution of glue or isinglass to form the composition; which is laid on the prepared model of the intended shaft, and is then floated with wooden moulds of the size required: during this operation, the colours are put upon the work as it forms, by which means it becomes incorporated with its substance; forming the veiny appearance so much admired. The workman, when the composition is fit for the operation, smooths the work with a pumice stone with one hand, while with the other he washes it with a spunge and water: he then polishes it with tripoli, charcoal, and a piece of fine linen; then he polishes it with a piece of felt, dipped in a mixture of oil and tripoli, finishing his operations with the application of pure oil, laid on with cotton wool. The bases and capitals of these columns are generally of real marble

Scala Santa, a portico near the church of St. John de Lateran, at Rome, with five arcades in front, and three flights of stairs, of which the middle flight is pretended to have been made out of the steps which once belonged to the house of Caiaphas, which they say were brought from Jerusalem to Rome, on account of their having served as a passage for Jesus, when he was transferred from Caiaphas to Pilate. The original steps, which are twenty-eight in number, are now covered with marble, to preserve them from being worn. They are ascended with great devotion.

Scale, (Sax.) a line divided into a certain number of equal parts, an instrument for measuring or plotting by, &c. See *Instruments*.

Scalene, in geometry, a triangle whose sides are all unequal.

Scamillus, a small plinth below the bases of the Ionic and Corinthian columns.

Scamozzi, *Vincenzo*, an Italian architect, born at Vicenza, in 1552, died in 1616. His father, Gian-Domenico, was also a skilful architect. He travelled to Rome, Venice, and Naples, to gain improvement, and among his works are the additions to the library of St. Mark, at at Venice, the finishing of the Olympic theatre at Vicenza, and a theatre at Sabioneta. His "Idea dell' Architettura Universale," in six books, was published in 1615.

Scamozzi's Rule, a two foot joint rule for the use of builders, so called from its inventor, the architect Scamozzi.

Scandulæ, flat pieces of wood used by the ancient Romans, in the place of tiles, to cover their houses. The people who made them were named *scandularii*, and were exempted from all public services.

Scantling, (Fr.) the dimensions of a piece of timber in breadth and thickness. Also, the name of a piece of timber, as of quartering for a partition, when under five inches square, or the rafter, purlin, or pole-plate of a roof. In masonry, scantling is the dimensions of stone in length, breadth, and thickness. See *Carpentry*.

Scape, (Lat.) a term sometimes given to the shaft of a column, more commonly to the place where it rises from the base.

Scarfing, the jointing and bolting of two pieces of timber together transversely, so that the two appear but as one. See *Constructive Carpentry*.

Scarp, in fortification, the slope on the side of a ditch which is next to the fortified place, and looks towards the field; also the foot of a rampart wall, or the sloping of a wall from the bottom of a work to the cordon on the side of the moat.

Scene, (Gr.) This word originally meant an alley, or rural portico, for shade and shelter. Cassiodorus says that theatrical pieces were first represented in such places as this. When first applied to a part of the theatre, it was used to indicate the wall which formed the back of the stage, but was afterwards more frequently applied to the whole stage, and was subsequently limited to its present signification. There were, according to Vitruvius, three principal scenes appertaining to the theatre, the *tragic*, the *comic*, and the *satyric*. Amongst the Greeks, the scene had, according to Vitruvius, the following disposition: in the middle was a great door, called the royal door, because it was decorated as the gate of a palace; at the sides were smaller doors, called *hospitalia*, because they represented the entrances to the habitations destined for strangers, which the Greeks commonly placed on the two sides of their houses. Some variation was occasionally introduced in the disposition and ornaments of the scene. Sometimes, particularly in satyrical pieces, as in the Cyclops of Euripides, instead of doors, caves were represented.

Scenography, (Gr.) the representation of solids in perspective.

Schola, (Lat.) the margin or platform surrounding the ancient baths. Also a portico corresponding to the exedra of the Greek palæstra.

Scholium, (Gr.) a note or remark, on a proposition, &c.

School, see *Academy*. There has been a great dearth of architectural schools in England. Batty Langley had a school or academy, but his disciples were all carpenters; and though his taste as an architect was below mediocrity, he produced many excellent workmen. One of our first regular bred genuine architects was the tasteful and scientific Wyat, who was the son of an eminent and opulent builder, acquired the elements of his art at home, and refined and purified his taste abroad from the purest sources, an absolute necessity in those days, for there was neither master or school in England, till that which he formed. In a similar school, and with similar advantages, did Milne gain the first prize in the first class of architecture at Rome, and was the first Briton who obtained a premium for art in that city. The encouragement shown to Chambers and Taylor, the establishment of the royal academy, and the triennial premium for architecture, founded a school from which sprung many able and tasteful men.

Sciagraphy, (Greek,) another name for a *section* of a building.

Scopas, a celebrated artist of Greece, who flourished in the year 430 before Christ, and was particularly distinguished as a statuary and sculptor. He executed one of the columns in the temple of Ephesus, and one of the four sides of the famous tomb of Mausoleus.

Scope, one of the machines of the theatre which represented an elevated tower, on which was placed the guards whose duty it was to watch over the public safety.

Scotia, (Gr. from *σκοτιος, shady*,) the hollow moulding in the bases of Ionic columns; also, the groove or channel cut in the projecting angle of the Doric corona. The Greeks call the scotia of the base *τροχιλον, trochilon*.

Scratch-work, (from the Ital. *sgraffiata*,) a kind of fresco, with a black ground, covered with a coat of white, which is afterwards scratched with a bodkin, or some pointed instrument, so that the black appears through the scratches.

Screen, (*escran*, old Fr.) partitions, generally wrought with rich tracery, &c. placed before small chapels and tombs, or behind the high altar. In old parish churches, oaken screens, richly carved, often divide the nave from the chancel. We sometimes, as at Exeter, find them at the side of choirs. See *Altar*. A *screen*, is also an instrument, consisting of three wooden ledges, joined in a rectangular frame at the bottom, the upper part of which is filled with wire work: its use is to sift sand or lime in making mortar.

Scribing, fitting the edge of a board to any surface, as of the skirting of a room to the floor. In joinery, it is the fitting one piece of wood to another, so that their fibres may be perpendicular to each other, the two edges being cut to an angle to join.

Scroll, see *Volute*.

Scutcheon, (Fr.) a shield for armorial bearings. In a contract for building Fotheringhay church, the term appears to be applied to signify a compartment of the exterior tower.

Sealing, fixing a piece of wood or iron (for hinges) to a wall, with cement, lead, &c.

Secant, (Lat.) a line which cuts another, a line cutting a circle from a point in the tangent to the centre.

Seclusorium, (Lat.) an apartment in the large aviaries of the Roman villas, where those birds were confined that were designed to be sold or killed.

Secos, see *Adytum*.

Section, in architectural drawings, a view of an edifice, as cut down the middle, showing the disposition of the interior. It is also called *sciagraphy*.

Sector, the space between two radii of a circle, and the part of the circumference which they include; a mathematical instrument, see *Instruments*. To find the area of a sector of a circle, multiply the radius by one-half of the arc.

Sector *of a Sphere*, a conical solid, whose vertex ends in the centre of the sphere, and whose base is a segment of the same sphere.

Segment, (Lat.) a part cut from any thing; the area contained by the arc of a circle and a cord.

In the segment of a circle, the cord of the arc is called the *base* of the segment, and the height of the arc the *height* of the segment. To find the area of the segment of a circle, when its base and height are given, find the area of the sector, (see *Sector*,) and the area of the triangle cut off by the chord; subtract the one from the other, and the remainder will be the area of the segment.

Segment *of a sphere*, a portion of a sphere cut off by a plane in any part except the centre, so that the base of such a segment must always be a circle, and its surface a part of the sphere.

Selinus, an ancient city of Sicily, which has been in ruins ever since its destruction by the Carthaginians. The most striking ruin is that of the great temple, probably that dedicated to Jupiter, which stood in the ancient forum. This Doric temple, like the generality of those dedicated to the supreme deity of the heathen mythology, was hypæthral, its form being octostyle-dipteral, having eight columns in each front, sixteen in the flanks, and a double row surrounding the cella. The columns of the east front were fluted, but some of the others seem quite plain, while others exhibit preparations for flutings more or less advanced, so that it is probable that it was left unfinished. The flutes are separated by a fillet. Within the cella was a double row of columns. The accumulated mass of ruins hinder a correct examination of this temple, but its whole length appears to have been 331 feet, and its breadth 161. The length of the cella Mr. Wilkins calculates at 110′ 5″ 6, and its width 67′ 3″. Diameter of columns of peristyles at base of shaft 10′ 7″ 5, below the capital 6′ 3″ 6, height including capital 48′ 7″. The capitals are each formed of a single block, the length of the abacus is 12′ 10″ and the height of the whole capital 4′ 9″ 5. The epistylia, which extended from the centre of one column to that of the other, are of one stone, 21′ 6″ long, 9′ 2″ 25 high, and five feet thick. The next temple is hexastyle peripteral, having six columns in front, and fourteen in the flanks, including corner columns. Length 186′ 4″, breadth 76′ 2″, on upper step. Diameter of columns at base 6′ 6″ 9, below the capital 4′ 1″ 9. The proportions of this temple are exactly similar to those of the temple of Jupiter. No traces of the wall of the cella are discernible. The third or southerly temple is hexastyle-peripteral, with sixteen columns in its flanks. Besides the cella and vestibules, it appears to have had an opisthodomus, or second cella, the wall of which, from its thickness, appears to have contained staircases. Length of temple, on upper step, 232′ 11″, breadth 83′ 10′. Height of columns 32′ 8″ 13, diameter at base 7′ 5″ 9, at capital 5′ 9″ 2. There are also remains of three other temples, upon what is supposed to have been the acropolis, but completely overthrown.

Sell, *see Sill.*

Semi, a Latin word which is used in composition with other words to signify half, as *semicircle*, a half circle.

Semicubical Paraboloid, in geometry, a curve whose ordinates are in subtriplicate of the duplicate proportion of the diameter, *i. e.* the cubes of the ordinates are as the squares of the diameters.

Senaria, (Lat.) a name given by the Romans to those pipes in their aqueducts, the diameter of which was an inch and a half, or six quarters; when the diameter was seven quarters, they were called *septenaria;* and the name was varied as the proportion increased up to the *vicenaria*, which measured twenty quarters or five inches in diameter.

Septa, or *Ovile*, (Lat.) a place in the Campus Martius at ancient Rome, where the people assembled to choose he magistrates.

Septangular, (Lat.) having seven angles.

Septizonium, the mausoleum of the family of Septimius Severus, at Rome, which was a large building, of a square pyramidal figure, with seven ranges of columns, and surmounted by the statue of Septimius. There was also an older building at Rome, which had the same name.

Sepulchral Arch, an arch over a tomb, with an inscription.

Sepulchral Monuments.—The custom of interring the dead is the most ancient, and prevailed both amongst the inhabitants of Greece and Italy, till it was superseded by the practice of burning them. In the Grecian colonies in Italy they buried their bodies entire, and even when the custom of burning them prevailed among the Romans, some families still preserved that of inhumation. This may be seen in the example of the family of the Cornelii, which preserved the custom of burying the body till the time of Sylla. The body of no member of this family had been burnt before, and this dictator ordered that his body should be placed on the funeral-pile, fearing lest it should be profaned like that of Marius was.

In Campania, several tombs of the ancient inhabitants have been discovered, and in them were found the beautiful vases called Etruscan, (see *Vase*,) of which several collections have been made and published. In the collections published by D'Hancarville and Tischbein, is represented one of the Campanian tombs as it appeared at the moment of its discovery. They were formed by an enclosure of cut stones, and covered with a sort of roof or flagstone, shelving on both sides. The dead body was stretched on the ground, the feet turned towards the entrance of the sepulchre, and the head ranged against the wall, from which were suspended, by bronze nails, vases of terra-cotta, whilst others of a similar kind were disposed around the body. In the plains of Etruria we find many sepulchral grottoes scooped in a shallow manner out of the rock, and excavated in various shapes.

Denon thinks that the custom and fashion of the sepulchres at Agrigentum are not Grecian, but Phœnician and Carthaginian. They are either troughs, one over the other, sometimes arched, or chambers with vent-holes in the roof, only two inches apart from each other. In some parts of Greece and Italy are sepulchral chambers excavated in the rock, and formed like a bell, as at Amphissa in Greece, described by Dodwell. Sepulchres excavated in rocks are older than the Roman æra. Another form of sepulchre is a square basement supporting five round pyramids, as that on the Appian way, erroneously termed the tomb of the Curiatii, and one among the remains of ancient Alba. These are also of great antiquity. In the valley of Ispica in Sicily, Denon found tombs formed out of a hollow stone, upwards of five feet long, and fifteen inches wide, and containing petrified bones.

Mr. Walpole says, that the most ancient form of the tumulus, is a heap of earth with a stele at the top. In parts of western Scythia they are found encompassed with a square wall formed of large square stones. This defence was also added to the early sepulchres of Greece and Asia, as in that of Opheltes at Cleonæ, (Pausan.) of Alyattes in Lydia, (Herod,) of Auge at Pergamus, of Æpytus in Arcadia, and of Phocus in Ægina (Pausan.) In one with a circular wall, which was opened between Smyrna and Pergamus, were found galleries and chambers. "The sepulchre of king Dercennus," Mr. Dodwell observes, "was, according to Virgil, a tumulus. This is probably the most ancient kind of sepulchres for great persons, the pyramid the second, and the *spelaion* the third. They generally contained sarcophagi, and were sometimes ornamented with the inscribed *stele*, or column, which is noticed by Homer. (Il. xvi. 457.) One of the tumuli in the plain of Athens has been excavated. It was found to contain a chamber, finely constructed of large blocks of stone, in which was a vase of terra-cotta, with figures and inscriptions."

A curious account of the barrows or tombs of the ancient Tartars is given in the second volume of the Archæologia. The Russians, in effecting a practicable road to China, discovered in 50° north latitude, between the rivers Irtish and Obalet, a desart of a very considerable extent, overspread in many parts with tumuli or barrows. This desart constitutes the southern boundary of Siberia. Strahlenberg, in his History of Russia and Tartary, (p. 4.) relates that in 1720, some Russian regiments being sent from Tobolski, the capital of Siberia, up the river Irtish, to the great plains, found in the tumuli there many antiquities, as they also did on the western boundary of the desart, between the rivers Tobal and Ischim. He also mentions (p. 325, 330.) that Scythian antiquities are annually brought from the pagan tombs which lie on each side of the river

Irtish, on the desarts of the Kalmuc Tartars. Mr. Bell gives a similar account in vol i. (p. 209.) of his journey from St. Petersburg to Pekin. From these circumstances it appears, that when any chief or person of distinction was interred, it was usual to bury in the same tumulus with him, his arms and favourite horse, &c. And this custom, which is said to be of great antiquity, prevails at this day among the Tartar hordes. The Russian court being informed of the depredations made on these tombs, by the borderers on the desart, sent a principal officer, with a party of soldiers, to open such of these tumuli as were too large for the maurauding parties to undertake, and to secure their contents. On surveying the numerous monuments of the dead spread over this great desart, he concluded that the barrow of the largest dimensions, most probably contained the remains of the prince or chief. In this he was not mistaken. After removing a very deep covering of earth and stones, the workmen came to three vaults, constructed of stones, of rude workmanship. That wherein the prince was deposited, which was in the centre, and the largest of the three, was easily distinguished by the sword, spear, bow, quiver, and arrow, which lay beside him. In the vault beyond him, towards which his feet lay, were his horse, bridle, saddle, and stirrups. The body of the prince lay in a reclining posture, upon a sheet of pure gold, extending from head to feet; and another sheet of gold, of the like dimensions, was spread over him. He was wrapped in a rich mantle, bordered with gold, and studded with rubies and emeralds. His head, neck, breast, and arms naked, and without any ornament. In the lesser vault lay the princess, distinguished by her female ornaments. She was placed reclining against the wall, with a gold chain of many links, set with rubies, round her neck, and gold bracelets round her arms. The head, breast, and arms were naked. The body was covered with a rich robe, but without any border of gold or jewels, and was laid on a sheet of fine gold, and covered over with another. The four sheets of gold weighed forty pounds. The robes of both looked fair and complete, but upon touching, crumbled into dust.

The tombs in the neighbourhood of Pergamus, in Asia Minor, are very ancient and simple, and resemble in structure the Scythian tombs observed by M. Pallas. They are cones of earth, raised with much art, upon the place which was occupied by the funeral pile, and which contained its remains. Sovereigns elevated these, to hold their whole families: hence these gigantic tombs and mountains, supported by interior vaults. The Asiatic princes observed the Scythian form, raised their sepulchres upon solid stone bases, and the natural vault was sometimes divided into many caves: of this last kind are the tombs of Pergamus. (See the Voyage Pittoresque de la Greece, tom ii.)

Panticapæum, now called Kertchy, in the Crimea, is rendered remarkable by its immense tumulus, called by some the tomb of Mithridates. It still exists almost entire, having a fosse in front. Several other very large tumuli are scattered about, and the plains are covered with them. It is called the *Altyn Obo*, and its shape is rather hemispherical. Its sides exhibit that stupendous masonry seen in the walls of Tiryns, where immense unshapen masses of stone are placed together without cement, according to their accidental forms. The western part is entire, although the others have fallen. Dr. Clarke compares it to the cairns of Scotland; but its exterior betrays a more artificial construction. The Tartars have not attempted to effect a passage into it, yet they entertain a notion that an entrance was once accomplished, and they describe the interior as a magnificent *vaulted* stone chamber, formed by enormous slabs, which seemed as if they would crush the spectator. It is remarkable that they should use this expression, because it agrees with the style used in the interior of other tumuli upon the Asiatic side. At Panticapæum are also an immense number of antiquities. (Clarke's Travels, vol. ii.) It is evident, that the custom of raising barrows over the deceased, survived the introduction of Christianity. That it continued among many of the Britons after the departure of the Romans, is also unquestionable; and perhaps it was not entirely relinquished before the middle of the eighth century, at which time Cuthbert introduced cemeteries within cities. The small earthen mound, still heaped over the remains of those who have trodden a humble path in life, is evidently a diminutive representation of the ancient barrow.

The following may be given as a rule for determining the dates, &c. of barrows in England. Those with cistvaens (see *Stonehenge*,) urns, cups, beads, weapons in wooden scabbards, bosses of shields, &c. are *British*. Those which are bell-shaped, in clusters, without any remains of garments, &c. are *Anglo-Saxon*. None appear to have been formed by the Danes, except where there were no stones to make pyramids or obelisks.

Roman sepulchres have been discovered in several parts of Britain. "The burial-places of the Romans," observes Mr. Douglas, "in this kingdom, are very rarely discovered, owing to their custom of interring the dead at no great distance from their stations, by the side of the public road, and in such situations as have been occupied by a succeeding people to modern times; and it is now only to accident we are indebted for the few remains which this country has preserved." (Nenia Britannica.) Many instances have occurred, where articles of Roman workmanship have been found with human remains, in Britain, beneath tumuli. But Mr. King observes, that "where Roman insignia have been found, we have very great reason to believe that the barrow, or cairn, was the sepulture, not of Romans, but of British officers, or chieftains, in the Roman service:" for "we do not find that the Romans ever raised barrows over the sepulchres or ashes of their great men, either in Italy or in any other part of the world." The general exterior characteristics of a Roman place of interment in Britain, appears to consist simply of the plain grave, with one or more stone pillars, bearing an inscription, and sometimes a sculptured device. Roman sepulchral inscriptions on stone have been found in most parts of this island, which are visited by a Roman road, although they most frequently occur in the vicinity of a known station. They are generally dedicated to military men, and are sculptured sometimes with the effigies of the deceased, and with garlands, &c. At Chatham hill, in Kent, a Roman sepulchre was discovered, of which the walls were composed of rubble stone, and hard mortar; the wall first discovered was thirty feet in length, and intersected by three apartments, with their walls. One apartment, which was complete, was nine feet three inches by seven feet three inches, with the inside of the walls covered with fine white plaster, on which were painted stripes of black and red. The urn, containing the ashes of the deceased, was deposited on a pavement within the sepulchre, and round it were several vessels of different size and shape, pateræ, &c. A Roman sepulchre, discovered about two hundred and fifty yards from the wall of the city of York, was an oblong room, with a ridged roof, covered with hollow Roman tiles: it was about three and a half feet long within, and contained several urns, all standing on a tiled pavement. A burial vault was discovered in Oxfordshire, which in the part explored was twenty feet long by eighteen wide, and eight high from "the planking stones." The human remains were laid in partitions of a dissimilar width, which crossed the vault from east to west, and were built with Roman red tiles, about eight inches and a half square. The partitions were two feet and a half deep, and generally about the width of modern graves. Roman urns and other vessels were discovered among the rubbish. There were two tiers of sepulchral recesses, and above was a range of planking tiles, covered with mortar and sand, in which was set tesselated work, supposed to have formed the flooring of a temple. When cremation ceased on the introduction of Christianity, the converted Romans and Britons betook themselves to the use of sarcophagi, or coffins. Stone coffins have been found in several instances in Britain, containing bones accompanied by urns and funeral vessels, apparently Roman. Roman coffins, of brick and of burnt stone, also occur. (Gough's Sepulchral Monuments — Beauties of England and Wales, for Oxfordshire, &c.)

In a Roman sepulchre discovered in 1794, at Ashby Puerorum, in Lincolnshire, the sepulchral urn was enclosed in a stone chest (or coffin) with a lid, which fitted the sides neatly, and rather hung over the edges. The chest was of freestone, such as is found in abundance on Lincoln heath; and the urn was made of strong glass, well manufactured, greenish, but not more so than green window-glass usually is. It was found while cutting a ditch in a ploughed field. The urn was nearly full of small pieces of bones much burned, many of them being white throughout their substance. (Archæologia, vol. xii. p. 96.) Among Roman sepulchres found at Lincoln, were many whole skeletons, and also "a sort of *cist-vaen*, or box formed of four stones, with a cover of the same, in which was enclosed an urn." (Archæolog. xii. 108, *et seq.*) In August, 1807 was discovered, in the suburbs on the southern side of the city of York, a Roman vault. It was broken into at one of the sides, in digging the foundation for a house. In the vault was a sarcophagus, cut out of a single grit-stone, and covered with a blue flag-stone, containing a skeleton in remarkable preservation, arising probably from its being immersed in water; the head elevated by being rested on a step. The length of the sarcophagus was seven feet, breadth three feet two inches, depth one foot six inches, thickness four inches. At the northern end of the vault was an aperture, too small to have admitted the sarcophagus, and carelessly closed with large stones. Near the vault an urn of red clay was discovered, containing ashes and fragments of burnt bones, (Archæologia, vol. xvi.)

That the Saxons, in common with other northern nations, at one period burnt their dead, and sometimes erected barrows or tumuli over their ashes, is proved by the numerous barrows that still remain in Lower Saxony; and Mr. Douglas, in his Nenia Britannica, supposes that in many instances small barrows placed in clusters must be ascribed to the Anglo-Saxons. But more careful researches have shewn that few tumuli in Great Britain are to be ascribed to the Saxons. The Saxons, it is believed, had once the same custom of burning their dead, as the Britons. "The custom of interring the body," says Mr. Turner, (History of the Anglo-Saxons,) "had become established at the era when their history began to be recorded by their Christian clergy, and was never discontinued. Their common coffins were wood; the more costly were stone. Thus, a man who had been buried in a wooden coffin was afterwards placed in one of stone, (Bede, l. iv. c. 19.) Their kings were interred in stone coffins, (Bede, c. 4,) they were buried in linen, (c. 19,) and the clergy in their vestments." Cuthbert, archbishop of Canterbury, obtained permission, about 750, for cemeteries to be made within cities; and from this circumstance some have supposed that church-yards were then first formed around the places of worship. Mr. Whitaker, however, in his History of Manchester, observes, "The custom of placing cemeteries around our churches, in England, is asserted by all our antiquaries to have been originally introduced by Cuthbert, archbishop of Canterbury, about the year 750. But they are as much mistaken in this, as I have already shown them to be in many other particulars. And the church-yard was every where laid out, at the time when the parish church was erected, among the kingdoms of the heptarchy. The churches in France had cemeteries about them, as early as 595; and those in England had them equally as early as the period of their own construction. The very first that was built by the Saxons in the kingdom, that of St. Peter and St. Paul, without the city of Canterbury, had an enclosure for sepulture about it; and the very first apostle of the Saxons, the pious and worthy Augustine, was actually buried within it. In sixteen years only after the conversion of the Northumbrians, the church of Lindisfarne appears encircled with its cemetery; and the head of Oswald, the slain monarch of the kingdom, and the body of Aidan, the bishop of the diocess, were equally interred there. And even the country church of St. Michael, distant about a mile and a half from Hexham, had a cemetery around it as early as 685." It became at an early period the custom of the English to bury within churches, such as were noted for their piety, their dignity, or their benefactions to the church or monastery. But the tombs were generally even with the pavement, and it does not appear probable that the Anglo-Saxons were accustomed to place figures in imitation of the human form, even on the tombs of the most illustrious deceased: and it is certain that no well authenticated monumental effigies of Saxon construction is now remaining. "Those we meet with for the kings of that race, such as Ina at Wells, Osric at Gloucester, Sebba and Ethelbert, which were in St. Paul's, or wherever else they occur, are undoubtedly cenotaphs, erected in later ages by the several abbeys and convents of which they were founders, in gratitude to benefactors so generous." (Archæolog. vol. ii. p. 293.)

The Anglo-Saxons naturally embraced the customs of the Christians, after their conversion. Soon after the arrival of St. Augustine, we find St. Awdrey, of Ely, laid in a marble coffin; for Sexburga, abbess of Ely, intending to remove the body of her sister Aedilreda or Awdrey, into the church, directed some of the brethren to seek for a stone "de quo locellum in hoc facere possent." They, finding no stone proper for the purpose in the isle, came to Grantacaester, "et mox inveniunt juxta muros civitatis *locellum de marmore albo pulcherrime factum*, operculo quoque similis lapidis aptissime tectum," (Bede, lib. iv. c. 19.) This is the oldest instance met with among the Saxons; but from this time, the use of stone coffins is often referred to.

The stone coffin is of very remote antiquity in this island, for the *cist-vaen* of the Britons appears to to have been the prototype of it. Some very singular stone coffins are described in the fifth volume of the Archæologia, p. 224. Stone coffins were at first made of several stones, set round, with one at the bottom, and one for the cover at top. Afterwards they were formed out of one single stone.

In the church at Christ Church, near Caerleon, is a very curious tomb-stone, with rudely sculptured effigies on it, which bears the date of 1300, in a barbarous and almost unintelligible Latin inscription that runs round it, (Archæolog. vol. v. p. 78.)

In parish churches, ancient sepulchral monuments are usually found in the chancel, or in small chapels or side aisles, which have been built, and frequently endowed, by some member of the families who are buried there. During the time of our Saxon ancestors, few or no monuments of this sort appear to have been erected; at least, being usually placed in the churches belonging to the greater abbeys, they felt the stroke of the general dissolution.

"The monuments of England," observes Mr. Gough, "are so few in the eleventh and twelfth centuries, and even in the thirteenth, that, after the most diligent search, there are periods which do not furnish any. The reigns of Henry III. and the two first Edwards afforded no small number; but it was under Edward III. and Richard II., that they multiplied so fast, that new ones are continually presenting themselves, and the number increases as we come nearer our own time." This writer has divided and classed tombs under eight different heads:

1st form; coffin-shaped stone, prismatic and plain at the top.

2nd form; prismatic and carved at the top, with crosses plain and fleury, as that of Theobald, archbishop of Canterbury, in 1160, and that of bishop Glanville, near the altar in Rochester cathedral.

3rd form; tables with effigies or sculpture, as that of Robert duke of Normandy, in Gloucester cathedral, with effigy cross-legged in a coat of mail, A. D. 1134. King John, in Worcester cathedral 1213. Prelates in pontifical habits, first in half-relief, afterwards complete effigies, as Herbert Walter, archbishop of Canterbury, 1205. Knights and nobles in armour, &c. as Longspee, earl of Salisbury, 1226.

4th form; tombs with festoons or arches over them, as those of Henry III. Edward I. queen Eleanor, Edward the black prince, Henry IV. &c. This class was succeeded by more lofty tombs, with arches crochets, pinnacles, finials, &c.

5th form; tombs in chapel burial-places, consisting mostly of open screens with doors, altar, monuments, piscines, niches, &c. several of which are seen in the cathedrals of Wells, Salisbury, Exeter, &c.

6th form; inlaid with brass, representing figures of the deceased, and inscriptions either in cameo or intaglio. These are mostly of the fourteenth century. Many fine specimens are engraved and published by Cotman.

7th form; against walls, which chiefly occur since the Reformation.

8th form; detached buildings, as domes, obelisks, columns, and equestrian statues.

It was long customary in Italy to raise the tombs of eminent persons upon pillars; that of the great Matteo Visconti, in the church of St. Eustorgio, in Milan, is mounted very high on six pillars, which stand upon the backs of three lions. And the Italians appear to have been always fond of representing their great men, and military worthies particularly, on horseback, both on their sepulchral monuments, and in public statues erected to their memories, as well as in paintings. (Archæolog. vol. xviii. p. 194.)

On ancient tombs the reader may consult Gutherius, de Jure Manium. The best collections of sepulchral monuments are—Montfaucon, les Monumens de la Monarchie Français; Millin, Antiq. Nationales; Gerbert, Topographia Principium Austriæ; I regali Sepolcri del Duomo di Palermo, fol. Nap. 1784; Sepulchral Monuments, by Gough, &c.

Seraglio, the palace of an eastern prince, more particularly that which contains the apartments of the females.

Serapeum, a celebrated temple of Serapis, at Alexandria, consisting of a vast square mass of building, the temple itself standing on an immense platform, supported on arches.

Serlio, *Sebastiano*, an eminent Italian architect of the early part of the sixteenth century, who was born at Bologna, and died in 1578. After having travelled through Italy, and resided a considerable time at Rome, he settled at Venice, where he built the palace of Grimani, and published a "Complete Treatise of Architecture," in 1537. He afterwards went to France, at the solicitation of Francis I. in 1541, where he was employed at Fontainbleau.

Sesqui-duplicate Ratio, in geometry, where two terms of the greater contain the less twice, with half over, as fifty to twenty. *Sesquialteral ratio*, is the ratio between two lines, numbers, &c. when one contains the other once with a half over, as six to nine. *Sesquitertian ratio*, is when one quantity contains the other once and a third over, as six to eight, or twelve to sixteen.

Sesspool, or *Cesspool*, a well sunk under the mouth of a drain, to receive the sediments which might choke its passage.

Set-off, a sloping face of masonry, marking the divisions of a buttress.

Setting, in masonry, fixing stones in walls or vaults.

Setting-out Rod, a rod in use among joiners for setting-out frames, as of windows, doors, &c.

Severy, (perhaps from *separare*,) a compartment, a division of scaffolding.

Severus's Wall, or *Vallum*, one of the barriers which were erected by the Romans across the northern part of our island, to restrain the incursions of the Scots. Severus died at York in 210. Dion Cassius mentions the great barrier that divides the island into two parts, as a thing existing when Severus undertook his expedition, and asserts, that this emperor, in the skirmishing warfare that the natives used against him, and in clearing away forests, levelling hills, draining morasses, and building bridges, lost at least fifty thousand men, and yet persisted in his design. And Herodian says, he made roads and bridges. But neither of these two authors, who are by far the most copious detailers of the actions of Severus, mention any wall of his building. Spartian, however, about sixty-five years after his death, not only asserts that he built a wall eighty miles long, across the island, but says that it was the chief glory of his reign. Aurelius Victor says it was thirty-three miles long, and Eutropius thirty-two; but Osorius and Cassiodorus make it one hundred and thirty-two. All who mention it agree that it passed from sea to sea. Spartian calls it *murus aut vallum;* Victor has *murus* in his large work, and *vallum* in his abridgment. Eutropius has *vallum.* Orosius calls it *magnum fossum firmissimumque vallum.* Antoninus, and the author of the Notitia, use the phrases *ad vallum* and *per lineam valli.* Bede and Gildas cite the words of Orosius, and the former observes "a *murus* is made of stones; but a *vallum*, by which camps, intended to repel the force of an enemy, are defended, is made of turf and earth, piled up high, like a *murus*, above ground, so that in the front, the place whence the earth was raised, forms a fosse, and upon this are fixed stakes, made of very strong beams of wood. Boethius and others mention Severus as repairing Adrian's Vallum. See *Adrian's Vallum.*

Sewer, (*asseour*, old Fr.) a subterranean channel or gutter for carrying off the superabundant water, filth, &c., of a town. The common sewers of Roman towns have been more or less imitated in the modern cities of Europe. They are said to have originated with the elder Tarquin, and were repaired and enlarged by Cato the Censor, and his colleague Valerius Flaccus. See *Cloaca.*

Sextant, (Lat.) the sixth part of a circle, or an arch of sixty degrees; an instrument of that form, for taking angles.

Shaft, (*sceaft*, Saxon,) the cylindrical part of a column, between the base and the capital. The shafts of large columns, when made of stone, are rarely of one piece. But it is possible to join the parts of a shaft in a manner so solid, that it will appear to be one single block. Wood, in his description of the ruins of Balbek, mentions a remarkable example of the solidity of shafts composed of several blocks, an example which proves at the same time that the ancients spared nothing in endeavouring to ensure solidity to their buildings. A very lofty column, the shaft of which was composed of three blocks, fell, and broke the stone of the wall against which it struck; even a fragment of the shaft itself, was broken off by the violence of the shock; yet the blocks were not in the least disjointed, although they were not joined with any cement or mortar. The temple to which this column belonged, was surrounded by a partico of fifty-four of the same kind. Before the period in which the Greeks brought architecture to that perfection which we still admire, we find among different people shafts of columns of various forms. The shaft of the Indian columns in the pagados of Salsette and Elephanta, is of small elevation, and is diminished in an undulating line. This form, which is disagreeable in other columns, has here no unpleasing effect, on account of their lowness. The generality of Egyptian columns appear to have had no diminution, but were perfectly straight, and of different forms and ornaments. According to Pococke, the general height of Egyptian columns was from three to five and a half, and, though very seldom, six diameters: the diameters vary from three to nine feet. The Persian columns, which have been found among the ruins of Persepolis, vary in form and height, they have a certain diminution, and are sometimes fluted. The columns of the Greeks were generally diminished in a straight line. The oldest Doric columns were low, and their diminution was so considerable, that the shaft was of a conical form: the upper diameter was often less than a third of the diameter at the bottom. The columns of the grand temple at Pæstum are an example. By degrees the lower part of the column was made less in proportion to the upper, and their height was increased: the superior diameter being not more than a quarter less than the inferior. This is the proportion generally observed in the Doric edifices at Athens. The diminution of the columns of the temple of Jupiter Nemeus, between Argos and Corinth, is not more than a fifth. The diminution of Ionic and Corinthian columns, differs much at different periods. The difference between the upper and lower diameters was from a fifth to a twelfth. It appears, indeed, that in the best periods of the art, the ancients had no exactly determined rule for the proportion of the diminution of their columns, but the architects seem to have regulated it according to their height. The Greeks almost always diminished their columns in a straight line. The Romans adopted the same mode of diminution, as we may see in those of the portico of the Pantheon, of the temple of Jupiter Stator, and, at a later period, in those of the temple of Antoninus and Faustina, of the portico of Septimus Severus, &c.

Besides the diminution in a straight line, which was the most used, Vitruvius also speaks of another kind of diminution, which he calls *entasis*. Many commentators on Vitruvius have imagined that by *entasis*, he means the swelling of the shaft, such as Palladio prescribes; that is, that, instead of decreasing the lower part of the shaft to one-third of the whole height, it increased from the foot. But it is not probable that Vitruvius intended by the term to express any such a swelling in the shaft, not only because it gives a bad effect to the column, but because the remains of ancient buildings offer us not a single example. By *entasis*, Vitruvius meant, without doubt, that the shaft was not to be diminished in a straight line, but in a line slightly curved outwards, without, however, any part of the shaft having a greater diameter than that of the foot. The Doric columns in the portico at Pæstum offer examples of such a diminution in a line slightly curved, instead of being perfectly straight. These columns depart most from the conic form towards the beginning of the upper half; but even there the diameter of the shaft is not more than at the foot, but it is, on the contrary, a little less.

Vitruvius does not explain in a very exact manner the form of this line of the *entasis*, and the design to which he refers has been lost.

A passage of the third chapter of his third book, throws, however, some light on the subject. He there fixes as a rule, that, in fluted Ionic columns, the width of a side comprised between two flutings ought to be equal to the swelling of the middle of the column. The column generally contains twenty-four flutings, and consequently as many sides. Each side having for its width the third of a fluting, it follows that its width is the ninety-sixth part of the circumference of the shaft, or the thirty-second part of his diameter. It appears, therefore, that this was the measure of the swelling of the middle of the column. This proportion at the same time agrees very well with that which we observe in the columns of the portico at Pæstum. The columns of several buildings at Rome, as the triumphal arch of Septimus Severus, that of Constantine, the theatre of Marcellus, the Coloseum, &c. offer us examples of another kind of diminution. One-third of the shaft of these columns arises from the base in a cylindric form, having the same diameter all its length. The two other thirds diminish in form of a cone. This is the most common mode of diminution. See *Entasis*, and *Diminishing*.

Shaft, in a chimney, is the stone or brick turret above the roof. The shaft of a king-post is the part between the joggles.

Shake, the fissure occasioned in timber by its being dried too suddenly, or exposed to too great heat. Any timber, when naturally full of slits or clefts, is said to be *shaky*.

Shank, (*scenca*, Sax.) the space between the channels of the Doric triglyph, which is sometimes termed the *leg of the triglyph:* Vitruvius calls it *femur*.

Shield, (*scyld*, Sax.) an ancient weapon of defence, borne on the arm, to send off lances, darts, &c. often used in architecture as a part of ornamental decorations. The shield was the most ornamental part of the ancient armour, being adorned with figures, and in the ages of chivalry bearing always painted on it the arms of its possessor.

Shingles, (*schindel*, German,) small oaken boards, used like slates to cover a building, from eight to twelve inches long, and about four broad, thicker at one side than the other. This kind of roof is not frequently used. The process of making a roof of this kind is called *shingling*.

Ship, see *Naval Architecture*.

Shoar, or *Shore*, (*score*, Sax.) a prop of timber, acting as a brace, in the side of a building, the upper end resting against that part of the wall on which the floor is supported, and both ends resting on plates or beams. A *dead shoar*, is an upright piece, built up in a wall, which has been cut or broken through for the purpose of making some alteration in the building.

Shoe, the part at the bottom of a leaden pipe, or water trunk, which is intended to turn the course of the water.

Shooting, planing the edge of a board straight, and out of winding.

Shooting-board, two boards which are joined together with their sides lapped upon each other, so as to form a rebate, for making short joints.

Shoulder, the plane transverse to the length of a piece of timber from which a tenon projects.

Shoulder *of a bastion*, in fortification, the place where the face and plank meet.

Shouldering Pieces, see *Brackets*.

Shread Head, see *Jerkin Head*.

Shredings, or *Furrings*, in old buildings, short slight pieces fixed as bearers below the roof, forming a straight line with the upper part of the rafters. See *Furrings*.

Shrine, (*scrinium*, Lat.) the tomb of a saint. The altar is sometimes called a shrine. The canopy over shrines, called *mandualis*, (whence *mantel-piece*) *requies*, *ripa*, &c. was sometimes so richly adorned with gold, silver, gems, and other ornaments, as to make a very brilliant appearance, on which account the shrines were covered in Lent. The form and condition of the shrine, and the annexation of an image to it, was of importance, because such tombs had greater privileges than plainer monuments.

Shrouds, *The.* A term applied to the parish church of St. Faith, in the crypt under St. Paul's: this name is also given to other subterranean churches.

Shutters, the boards which shut up the aperture of a window.

Side-posts, a kind of truss-posts placed in pairs, each disposed at the same distance from the middle of the truss, for the purpose of supporting the principal rafters, braces, crown or camber beams, as well as for hanging the tiebeam below.

Side-timbers, another name for purlins, as is also *side-wavers*, which is used in Lincolnshire: the former term is chiefly confined to Somersetshire.

Signinum Opus, (Lat.) a kind of work mentioned by Vitruvius, lib. viii. c. 7, which was used by the ancient Romans in the construction of walls and cisterns. They mixed five parts of pure sand and two of lime, to which, when well stirred together, they added pieces of soft sandy stone, each about a pound weight. This mass served to cover the walls or groundwork; and, to increase its solidity, they beat it with logs of wood pointed with iron. According to Pliny, the *signinum opus* was composed of pounded tiles and lime.

Sill or *cill*, (*syl*, Sax.) the timber or stone at the foot of a door, &c. *Ground sills*, are the timbers on the ground, which support the posts and superstructure of a timber building. The name of *sill* is also given to the bottom pieces which support quarter and truss partitions.

Sillon, in fortification, an elevation of earth in the middle of a moat.

Sima, see *Cyma*, and *Mouldings*.

Similar, figures, &c. which have equal angles and proportional sides.

Sine, a right line drawn from one end of an arch, perpendicular upon the diameter, or it is half the chord of twice the arch. The sine of the complement is the sine of what the arch wants of ninety degrees. The *versed sine*, is an arc or angle less than ninety degrees, being that part of the diameter, which is comprehended between the arch and the sine.

Single-frame and Naked, is a term applied to a floor which has only one tier of joists. A *single-joist floor*, is one that has no binding joists.

Single-hung: when only one sash of a window is moveable in the same vertical plane, the sashes are said to be *single-hung*.

Single Joists, joists which are employed singly in a floor.

Single Measure, a door which

is square on both sides: if it be moulded on both sides, it is *double measure*, and if moulded on one side and square on the other, it is said to be *measure and a half.*

Siparium, (Lat.) a curtain which was often employed instead of a door, to separate one room from another. It was used in temples to conceal the image of the deity, when sacrifice was not performing. It was also raised before the tribunal of the judges in criminal causes, to admit of their discussing the subject with greater secrecy: in cases of less importance, the veil was left undrawn, and hence arose the expression *ad vela sisti* to denote the curtain being drawn, and *levato velo* to signify an open investigation.

Sisypheium, (Gr.) a temple at Corinth, which is described by Strado, built of white marble. Its site is not exactly known. Chandler supposes it to be the temple that is described by Stuart in his Antiquities of Athens. But the difference of the materials is an objection to this supposition. The ruin described by Stuart is "a Doric temple, apparently of great antiquity, and built before architecture had received the improvements it afterwards did in the time of Pericles." Twelve columns remain. They are made of the stone called *porus*, (πορινος λιθος.) They have twenty flutings, which terminate under the listels of the capital, and are segments of circles. The guttæ are round, and detached from the architrave. The shafts are each of one block only, and the whole has been covered with stucco. It may be observed, that the temples in Greece, Sicily, and Italy, built with the same stone, are generally found to have been extremely thinly stuccoed with a fine cement, and afterwards painted. The architraves are of one stone, reaching from centre to centre of the columns. In plate *Carpentry*, C. 44, *fig. a, b, c,* show the form of the flutings, of the guttæ, and of the grooves and necking of the capitals of these columns; they are taken from the drawings of Sebastian Ittar, an Italian artist employed by lord Elgin, which are now in the British Museum.

Skias, (Gr. a *shadow, shady-place,*) an edifice at Lacedemon, which served as a place of public assembly to the people. It was the work of Theodorus of Samos, to whom is attributed the invention of casting iron, and of making statues of it. It was to the roof of this edifice that the Lacedemonians suspended the lyre of Timotheus of Miletus, after having punished this musician, for having added four more strings to the seven strings of the ancient lyre.

Skirtings, the narrow boards which form a plinth round the margin of a floor.

Skirts, several superficies, in a plane, which would cover a body without one part lapping over the other.

Skreen, an instrument used in making mortar, see *Screen.*

Skylights, frames with one or two inclined planes of glass, placed in a roof to give light to the rooms or passages below, and looking to the sky.

Slab, the outside plank cut off a tree, which is of unequal thickness.

Slating, covering roofs with slates. The slates used in London are brought chiefly from Bangor, in Caernarvonshire. But the most esteemed is a pale blue-green slate, brought from Kendal, in Westmoreland, and called *Westmoreland slates.* The Scotch slates are not in much repute. The Welsh slates are known by the following names, according to their average sizes.

	Length.		Breadth.	
	ft.	in.	ft.	in.
Doubles	1	1		6
Ladies	1	3		8
Countesses . . .	1	8		10
Duchesses . . .	2	0	1	0
Welsh Rags . . .	3	0	2	0
Queens . . ; .	3	0	2	0
Imperials	2	6	2	0
Patent	2	6	2	0

Slate is separated from its bed, like other stones, by means of gunpowder, and is afterwards separated into layers called *scantlings*, by wedges, and finally sawn to the respective sizes by means of machinery. The blue, green, purple, and darker kinds, are most capable of being split thin, the lighter colours being coarser, and used chiefly for stabling, out-houses, &c. The instruments used in quarrying slates, and splitting them, are slate-knives, axes, bars, and wedges. In laying them on the roofs, and fixing them, are used the *saixe*, an instrument made of tempered iron, about sixteen inches long, and two wide, resembling a large knife, bent a little at one end, with a wooden handle at the other, having a projecting piece of iron on its back, drawn to a sharp point, about three inches long: it is used to chip and cut the slates to their required sizes, as, when brought from the quarry, they are not sufficiently squared and cleaned for the slaters' use. The *ripper* is an iron instrument, about the same length as the saixe, with a very thin blade, tapered somewhat towards the top, where a round head projects over the blade about half an inch on each side: there are also two little round notches in the two internal angles: the handle is raised above the blade by a shoulder. It is used in repairing old slating, to remove the old slates for the purpose of inserting new ones. The *shaving tool*, consists of an iron blade sharpened at one end like a chisel, and mortised through the centre of two round wooden handles, one fixed at one end, and the other about the middle of the blade, which is about eleven inches long and two wide, and is used for getting the slates to a smooth face for skirtings, floors of balconies, &c. The *hammer* used by slaters differs from common hammers, in being bent back at the top, which is ground to a tolerably sharp point, and in having on the other end of the driving part a small projection, with a notch in the centre, which is used as a claw to extract such nails as do not drive well. Other tools used, by the slater are chisels, gouges, and files.

In slating roofs, the first thing is to have a floor or base to lay the slates compactly and securely on; and for doubles and ladies' boarding is required, which must be even, closely jointed, and well secured to the rafters. The slater next provides himself with slips of wood, called *tilting slates*, about ten inches and a half wide, three-quarters of an inch thick at one edge, and champfered to an arris on the other. These he nails down all along the extreme edges of the roof. Having selected the largest slates, he arranges them regularly along the eaves, with their lower edges to a line, nailing them to the boarding. After this, he takes others, with which he forms the bond to the under sides of the eaves, placing them under those previously laid, in such a manner as to cross and cover their joints; these must be slightly pushed up under the others, and are seldom nailed, as they are held in their places by the weight of those above them. He next lays another line over the first row, covering its joists by crossing and lapping a sufficient way over them, and in this way continues them to the pitch of the roof. Layers of slates may, instead of having a flooring, be laid on *battens*, or narrow pieces of deal, about two and a half or three inches wide, four of them being generally made out of an eleven-inch board.

In covering a roof with *patent slates*, which were first brought into use by Mr. Wyatt, the common rafters must be left loose upon their purlins, as they require to be so arranged, that a rafter may lie under all the meeting joists, hence neither boarding nor battens will be needed, and since the number of rafters depends on the width of the slates, when they are large, very few are necessary. This kind of slating may be laid on a much less elevated rafter than any other, as the laps being much less than in common slating, it is considerably lighter. It is likewise commenced at the eaves, but is neither crossed nor bonded, the slates lying uniformly, with each end reaching to the middle of the rafter, and butted up to each other through the length of the roof. The eave slates are screwed down to the rafters by two or three strong inch-and-a-half screws, at each of their ends. The joints are secured by *filleting*, or covering them with fillets of slates, about three inches wide, bedded in putty, and screwed down through the whole into the rafters. Slating is sometimes laid in a lozenge form, but it is much less durable than the common method.

A species of artificial slates have been used in Russia, which are said to be very valuable, as being lighter than common slates, impervious to water, incombustible, and made of any required form or size. They have been analyzed by M. Giorgi, who finds them to consist of bolar earth, chalk, or carbonate of lime, strong glue, paper pulp, and linseed-oil. The earthy materials are to be pounded and sifted, and the glue dissolved in water; the paper is the common paper pulp, which, after being steeped in water, has been pressed; or it may be book-binders' or stationers' shavings boilded in water and pressed. The linseed oil is to be raw. The paper pulp is to be mixed in a mortar with the dissolving glue, the earthy materials then added and beaten up, and the oil added during the beating, as fast as it is absorbed. The mixture is then spread with a trowel on a plank, on which a sheet of paper has been laid, and surrounded by a ledge, to determine the thickness of the layer, and is then turned out on a plank, strewed with sand to dry. When dry, they are passed through a rolling-mill, then pressed, and finally finished by a coat of drying oil.

The following are some of the various proportions recommended:

Two parts paper pulp, one glue, one chalk, two bole earth, one linseed oil; this forms a thin, hard, and very smooth sheet.

Three parts paper pulp, four glue, four white bole earth, and four chalk; this produces an uniform sheet as hard as iron.

One paper pulp, one glue, three white bole earth, one linseed oil; this makes a beautiful elastic sheet.

When these plates or slates were steeped in water for four months, they were found not to alter at all in weight; and when exposed to a violent heat for five minutes, they were scarcely altered in form, and were converted into black and very hard plates.

Sleepers, timbers laid upon dwarf walls, for supporting the ground joists of floors; cross timbers for fixing the planking, where it is necessary to pile under, in order to make a secure foundation.

Slit Deal, inch-and-quarter deal cut into two boards.

Slyp, in old architecture, a passage between two walls.

Snipe's Bill, see *Plane*.

Socket Chisel, a chisel used in mortising.

Socle. See *Zocle.*

Soffit, or *Soffita*, the under part or ceiling of a cornice; any timber ceiling formed of cross beams of flying cornices, the square compartments or panels of which are enriched with sculpture or painting, as in the Italian palaces; the under side or face of an architrave; and more particularly that part of the corona, or larmier, which was called by the ancients *lacunaria*, and which is termed by the French *plafond*, and by us usually the *drip*. The word *soffit* is also applied to the ceiling of an arch. See *Carpentry*.

Soffits *of Canopies*, the inner part, sometimes with groined tracery, forming a vaulted arch with a pendant.

Soils, a provincial term for the principal rafters of a roof.

Solar, or *Solyer*, a light upper room.

Solarium, (Lat.) (1.) a sun-dial, (see *Sun-dial*, *Horologium*, *&c.*) (2.) a platform at the top of the ancient houses, where the inmates occasionally walked to take the air; (3.) a tax levied on those who received permission to build upon the public ground, levied by the curators of the public places.

Solder, or *Sodder*, (*soldare*, Ital.) a metallic or mineral composition used in *soldering* or joining together other metals

Solid, in geometry, a body which has length, breadth, and thickness.

Solids, *Architectural.* In plate I, *fig.* 1 is a semi-cylinder, being the centre of a semi-cylindric vault; *fig.* 2, a semi-cylindroid, being the centre of a semi-cylindroidic vault upon the greater axis of the ellipse, which forms the ends of the vault; *fig.* 3, a semi-cylindroid being the centre of a semi-cylindroidic vault upon the axis minor of the ellipse, which forms the ends of the vault; *fig.* 4, and 5, groins upon a square plan, proving their summits in curved lines; *fig.* 6, a groin springing from the angles of a square base, but of which their horizontal sections are every where quadrantal arcs of a circle; hence the four surfaces meet each other in a horizontal plane, and terminate in a quadrant; the quadrilateral space is filled with a circular figure. In plate II, *figs.* 1, 2, 3, gothic groins, their summits being straight, 1, being upon a square plan; 3, on a rectangular plan; and 2, on an octagonal plan; *fig.* 7, a groin of the same kind as *fig.* 6. on plate I, upon an oblong plan; *fig.* 8, gothic arches penetrating a polygonal dome of the same number of sides; *fig.* 9. gothic arches penetrating a spherical dome.

Solid Angle, an angle formed by three or more plane angles, which meet in a point, and of which the sum of all the plane angles is less than three hundred and sixty degrees.

Soline, a term among French carpenters, for a joist or rafter, which is either slit or sawed, and with which they lay their ceilings.

Sommer, see *Summer*.

Sophia, St. See *Constantinople*.

Sostratus, a celebrated Grecian architect, of the third century before Christ, born at Cnidos in Asia Minor; his father Dexiphanes was also celebrated as an architect. Sostratus is renowned in history for the terraces and arcades with which he adorned his native city, and was patronized by Ptolemy Philadelphus, king of Egypt. He was the builder of the celebrated Pharos, which protected the entrance to the port of Alexandria, and is said to have given celebrity to his name by a singular stratagem: having been ordered to engrave on the tower the words "King Ptolemy to the Gods, the Saviours, for the benefit of Sailors," he substituted his own name instead of that of Ptolemy, and having filled it up with mortar, painted over it the original inscription, so that, after it had been some time exposed to the action of the weather, the mortar came off, and the inscription appeared according to the first engraving, "Sostratus, son of Dexiphanes, of Cnidos, to the Gods, the Saviours, for the benefit of Sailors," and continued so as long as the tower remained standing.

*Soufflot, *James Germain*, a French architect, who was born at Irancy, near Auxerre, in 1714, and died in 1780. He was first intended by his father, who was an *avocat*, for the profession of the law, but preferring that of architecture, he studied it some time at Lyons, afterwards travelled into Italy, and, on his return, was admitted into the number of the king's pensioners. His works at Lyons, particularly the hospital, gained him great reputation. He afterwards visited Italy a second time, and settled on his return at Paris. Amongst his other works are the exchange, the concert-room, and the theatre of Lyons, and the portal, nave, and towers of the church of St. Geneviève. A collection of designs which he left behind him were published by M. Dumont, under the title of "Elévations et Coupes de quelques Edifices de France et d'Italie, désignées par feu M. Soufflot, architect du Roi, et gravées."

Sound Boarding, short boards which are disposed transversely between the joists of floors, for holding any substance which is intended to prevent sound from being transmitted from one story to another. They are supported by fillets fixed to the sides of the joists, generally about three quarters of an inch thick, and an inch long. The substance which is placed between them, to prevent the transmission of the sound, is technically termed *pugging*.

Sounding Board. The church of Attercliffe, near Sheffield, had long been remarkable for the difficulty and indistinctness with which the voice from the pulpit was heard: these defects were completely remedied by the erection of a concave sounding board, having the form resulting from half a revolution of one branch of a parabola on its axis. It is made of pine-wood; its axis is inclined forward to the plane of the floor, at an angle of about ten or fifteen degrees; it is elevated so that the speaker's mouth may be in the focus; and a small curvilinear portion is removed on each side from beneath, so that the view of the preacher from the side galleries may not be intercepted. The effect of this sounding board has been to increase the volume of the sound to nearly five times what it was before, so that the voice is now distinctly audible in the remotest parts of the church, and more especially in those places, however distant they may be, which are situated in the prolongation of the axis of the paraboloid. The side galleries are also benefited, probably from the increase of the secondary vibrations excited in a lateral direction.

Souse, (Fr.) or *source*, a support or under prop.

Spalatro, a town of Venetian Dalmatia, where are the splendid remains of a palace of the emperor Dioclesian, which has been described, and several fine plates given of it by Mr. Adam. This building was of a quadrangular form, divided by two large streets, which crossed at right angles, and led to the different gates. These streets were bordered on each side by arcades thirteen feet in width, many of which are still entire. The first street led directly to the peristyle before the villa, from which a flight of steps led into the porticus, and from this were two doors to two winding stairs, which led to the ground story, that the slaves might have access there without having to pass any of the apartments. Next to the porticus is the vestibule, which was lighted through the roof. From this we enter the atrium, on each side of the door, into which were two small rooms, one of which may have been the porter's lodge, and the other the tablinum, or repository of the records. By the alæ of the atrium are the two andrones or mesaulæ, from which there is access to several great rooms, which received light from the roof. Next to the atrium is the cryptoporticus. The first room on the ground-floor is the basilica, for dramatic performances, concerts, &c.; next the œci or eating apartments, and the exedræ or drawing-rooms; and then the bath and its apartments, and the bed-chambers. Temples were placed in the two areas adjoining the palace. The whole area which is covered by the palace is nine and a half English acres.

Span-piece, a name given in some places to the collar-beam.

Span Roof, a name sometimes given to the most common species of roofing, which is formed by two inclined planes.

Spandrel Bracketing, brackets which are placed between curves, each of which are in a vertical plane, and in the circumference of a circle, which is in a horizontal plane.

Spars, the common rafters of a roof for supporting the tiling or slating.

Specific Gravity, a comparison of the weight of any quantity of solid or fluid, with the weight of some other fluid or solid, chosen as a standard, which is generally rain water, as being least subject to variation, and of which a cubic foot weighs 1000 ounces avoirdupois. For tables of the specific gravity of different substances, see the articles *Stone* and *Timber*.

Specus, (Lat.) the canal into which the water flows, in aqueducts which are raised above the surface of the ground, constructed of hewn stones or bricks. It was covered with a vault, to preserve the water from the warmth of the sun, and from being mixed with rain-water. Sometimes these canals were covered with flat stones, laid horizontally, as in the Aqua Marcia, a part of the Aqua Claudia, and the aqueduct of Segovia. Sometimes the same series of arcades supported several of these canals, of which there were often three placed one above another: thus the Aqua Julia, Tepula, and Marcia, were supported by the same arcades; another example may be instanced in the Anio Vetus, and the Aqua Claudia.

Sphæristerium, a building appropriated for exercising with a ball; a tennis-court. The ancients generally placed Sphæristeria among the apartments that were connected with their baths, and in their gymnasia. They also had them in their mansions, and particularly in the villas of the rich. Pliny the younger, in the description which he gives of his two country houses, mentions the *sphæristerium.* The emperor Vespasian had one in his palace, and, according to Lampridius, Alexander Severus very frequently exercised in the Sphæristerium.

Sphere, (σφαιρα, Gr.) a solid body contained under one single surface, and having a point in the middle called its centre, from whence all the lines drawn to the surface are equal. A solid approaching the figure of a sphere, but not exactly round, formed by the revolution of a semi-ellipsis about its axis, is called a *spheroid.* When it is generated by the revolution of a semi-ellipsis about its longest or transverse diameter, it is called an *oblong spheroid;* when about its shortest or conjugate diameter, it is a *prolate spheroid.* The fixed axis of the ellipse is called the *axis of rotation.* The circle described by the semi-axis of the ellipse is called the *equatorial circle.* To find the solidity of a sphere, or spheroid, multiply the square of the equatorial diameter, by the axis of rotation, and the product by, 5236. If the equatorial diameter be equal to the axis of rotation, multiply the cube of the diameter by 5236.

Spherical Bracketing, brackets of such a form, that the surface of the lath-and-plaster work which they support, will form a spherical surface.

Spherics, the doctrine of the sphere.

Spheroid, see *Sphere.*

Spheroidal Bracketing, bracketing which has the surface of a spheroid.

Sphinx, (Greek,) a figure of a monster with the head and breasts of a woman, the wings of a bird, the claws of a lion, and the rest of the body like a dog: we find it most frequently occurring amongst the ornaments of the Egyptian temples, from whom it was borrowed by the Romans, who placed it also very often in the porches of their temples.

Spiral, a curve line of a circular kind, which in its progress recedes from its centre.

Spire, (Gr. σπαιρα, *twisting,*) among the ancients, was the base of a column, and sometimes the astragal or torus, but among the moderns it designates a steeple which diminishes as it ascends either pyramidally or conically.

Splayed, (*disployer*, old French, to spread out); the heading joists of a boarded floor, the jambs of a door, or any thing else, of which one side makes an oblique angle with the other, is said to be *splayed.*

Spring Bevel *of a Rail*, the angle which the top of the plank makes with a vertical plane, that has its termination in the concave side, and touches the ends of the rail-piece.

Springing, setting the boards of a boarded roof together with bevel joints.

Springing Course, the horizontal course of stones whence an arch rises.

Square, (*quadra*, Lat.) a figure of four equal sides, and as many equal angles; an area, generally of this form, surrounded by houses, and ornamented with an enclosed lawn, with shrubs, trees, &c.; an instrument used by mechanics, composed of two rules fastened perpendicularly at one end of their extremities, so as to form a right angle, and used for measuring and describing right angles and perpendiculars: when one ruler joins the other in the middle in the form of ⊣, it is called a *T square*.

Squaring *hand rails*, the cutting of a plank to the form of a rail for a stair-case.

Stadium, (Greek,) among the Greeks, the open space where the athletæ exercised in running, and where they combated for the prize. In its primitive signification, the word signified properly that part of the gymnasia, where the people assembled to witness the different athletic exercises: according to the description of Vitruvius, it was a place so disposed that those whom curiosity or idleness might conduct there, could conveniently view from it the combats of the athletæ. This place, which was much longer than broad, was rounded at one of its extremities, and furnished with several ranges of seats for the spectators. In its other signification, the word *stadium* was used for the place itself where the public games were celebrated. Thus the place where they celebrated the Olympic games was called the *Olympic stadium*: that where the Pythian games were celebrated, the *Pythian stadium*. Ancient authors mention three parts of the stadium, which were the entrance, the middle, and the extremity of the career. The entrance had four different names. It was called *apheteria*, a word derived from a Greek verb, signifying to set off, or start, it being the place from whence the race commenced. As the entrance was marked by a simple line drawn across the stadium, it was also called the *gramme* or line, as the term is explained by Pollux and Suidas. Instead of the line, a step or slight eminence was introduced, when it was named *balbis*. Besides this line was placed a kind of barrier, to stop the racers till the signal was given, which was a chord, &c. and was let fall at the moment of starting: hence this entrance was termed *hysplex* or *hysplenx*, and in Latin *regula* the rule. In the middle of the stadium was generally placed the prize, according to Faber in his Agonisticon. The extremity of the stadium was sometimes called *gramme* and *balbis*, like the entrance, but it had also several other particular names, such as *terma*, *batêr*, *telos*, *kamptêr*, and *nyssa*.

The stadia often made part of the gymnasia. At Thebes there was a gymnasium which bore the name of Hercules, and which contained a stadium. Sometimes the stadium was a structure separated from the gymnasium. The greatest part of the stadia of Greece were only surrounded by a bank of earth; though there were some of a more elegant construction. On the Isthmus of Corith there was, according to Pausanias, a stadium built of white marble. In the upper part of the city of Delphos, there was a stadium constructed at first only of the stone of Parnassus, but which was afterwards adorned by Herodes Atticus, with Pentelic marble. Chandler and Pococke inform us, that there was at Smyrna and Ephesus also a stadium which did not make part of a gymnasium. At Alabanda, Chandler saw the ruins of a stadium which serves now for a public market for the town of Karpuseli, which is built on the site of the ancient city. At Laodicea have also been discovered the ruins of a stadium, figured in the Ionian antiquities. One of the most magnificent and celebrated stadia of antiquity, was that described by Pausanias at Athens, which was built by Herodes Atticus, of Pentelic marble, and of extraordinary extent.

Stadium, a measure of ground among the ancient Greeks, containing 125 paces..

Staff Bead, see *Angle Staff*.

Stair-case, an ascent of stairs, enclosed between walls or balustrades, with landing-places, &c. Vitruvius, in describing the houses of the ancients, does not mention the stairs; as the ancient houses appear to have only had a ground-floor, they were the part of least consequence, and the stairs for ascending the roof, or to communicate between different floors, where the houses had more than one, appear to have been either on the outside of the walls, or worked in them. However, we find instances of the stair-cases being disposed in the same manner as at the present day. The building called the country-house at Pompeii, and several others, have stair-cases of modern appearance, but narrow and incommodious, with steps sometimes a foot high. We find occasionally, likewise, private stair-cases, as in Pliny's Tusculan villa, where it was situated by the side of the dining room, and destined for the use of the slaves who served the repast. There were also stair-cases in many of the ancient temples, to ascend to the roof, &c.

Great skill is often displayed by modern builders in the disposition of the stair-case, that it may possess convenience of access, without interfering with the distribution of the different apartments. In common houses it is generally of wood, but in public edifices, and the residences of the nobility, it is more commonly of stone or marble.

"Staircases," Palladio observes, "will be commendable, if they are clear, ample, and commodious to ascend, inviting, as it were, people to go up: they will be clear, if they have a bright and equally diffused light; they will be sufficiently ample, if they do not seem scanty and narrow to the size and quality of the fabric, but they should never be less than four feet in width, that two persons may pass each other: they will be convenient, with respect to the whole building, if the arches under them can be used for domestic purposes; and with respect to persons, if their ascent is not too steep and difficult, to avoid which, the steps should be twice as broad as high." The most convenient height for the steps is from four to six inches, and their number, according to the direction of Palladio, should not exceed thirteen before arriving at a resting place. The most common form of stair-cases in dwelling houses is rectilinear, but they are capable of being made much more elegant in a circular or elliptical form. Small circular stair-cases are generally formed round a column, or newel, and hence called *newel stair-cases*. In large designs the elliptic form is preferable to all others. One of the finest examples may be seen in Somerset House, in the stair-case belonging to the Royal Society and the Society of Antiquaries.

In the construction of stairs, the principal thing to be attended to, is their strength and safety, both in reality and appearance, and their easy ascent. Blondel, in his Cours d'Architecture, is believed to have been the first who fixed the relation between the height and width of a step upon correct principles. The following equation will very nearly express the true values of x and z: Supposing that a person, walking upon a level plane, move over a space $= x$ at each step, and that the height that the step, and that the height that the same person could with equal ease ascend vertically, be z; for, if h be the height of the step, and p its width, the relation between p and h must be such, that when $p=x$, $h=o$, and when $h=z$, $p=o$. These conditions are satisfied by an equation of the form of $h=z\,(1-\frac{p}{x}:)$ Blondel assumes 24 inches for the value of x, and 12 for that of z; substituting therefore these values in the equation, it becomes $h=\frac{1}{2}(24-p,)$ and $p=24-2\,h$: and if the height of a step be 6 inches, then the width will be $24-12=12$ inches.

Straight stairs are such as always *fly*, that is, proceed in a right line, and never wind. Some of these are triangular, or fly round by the sides of a triangular newel, either solid or open, having at each corner a tapering half-step, taking up two-thirds of a circle. *French fliers*, fly first directly forwards, till they come within the length of a stair of the wall, then have a square half-place, which is followed immediately by another half-place, from which the stairs fly directly back again, parallel to their first flight. Winding stairs never fly, but always wind, either about a solid newel, or an open newel. Palladio directs the newel to be one-half of the diameter of the stair-case, and recommends that in a stair-case 6 or 7 feet in diameter, the stairs in each revolution should be twelve; in a diameter of 8 feet, sixteen; and in a diameter 9 or 10 feet, twenty; and if 18 feet, twenty-four steps. Elliptical winding stairs differ only from circular stairs in having their newel an ellipsis instead of a circle; and square winding stairs, in having it double winding staircase, made by Pietro del Boyo and John Cossin, so contrived, that two persons, the so contrived, tnat two persons, the one ascending, and the other descending, should never meet. And Palladio mentions a quadrangular one at the castle of Chamboo, near Blois. *Mixed stairs* are such as partly wind and partly fly, and include *dog-legged stairs*, or such as fly directly forwards, wind in a semicircle, and then fly back; and square flyers and windows, having a square newel, by the side of which they fly, and wind at each corner a quarter of a circle.

Stairs, (*stæres*, Sax.) steps to ascend from the lower part of buildings to the upper.

Stalk, (*Stealcan*, Sax.) a kind of ornament in the Corinthian capital, which is sometimes fluted, and resembles a stalk, and from which spring the volutes and helixes.

Stall, (*stal*, Sax.) an elevated seat in the choir or chancel of a church, appropriated to an ecclesiastic, as the prebend stalls in a cathedral. They had sometimes desks and canopies. Stalls or seats contiguous to the high altar, were for the priest, deacon, and sub-deacon, who sat whilst certain parts were sung by the choristers.

Stancheon, (*estançon*, Fr.) a prop, or support, the perpendicular mullions or upright bars of a window or open screen. Also, a puncheon.

Stand, (*standan*, Sax.) a solid square body placed under pedestals, vases, &c.

Standard, (*étendard*, Fr.) a rule or measure for regulating others; a banner or flag.

Standards, the upright pieces of plate rack, used above a dresser; the upright poles in scaffolding.

Star-fort, in fortification, a [illegible] with salient and re-entering angles. A *star-redoubt*, is a redoubt built in the same form.

Staves, boards joined together laterally, to form a hollow cylinder, cone, &c. for the shaft of a wooden column, or any other purpose.

Steel, (*stal*, Sax.) iron united with carbon. There are two ways of making steel, by fusion and by cementation. The first is used to convert iron into steel immediately from the ore, or from crude or cast iron. By the second way bar iron is exposed to a strong continued heat, covered with charcoal. The process for converting iron into steel was known to the ancients. The Romans called it *chalybs*, because it came from near the river Chalybs, in Spain, the water of which was used in tempering it. It is probable that the famous iron manufactory at Bilboa, said by Anderson to have commenced in 989, was only a continuance of their ancient skill. The casting of steel was introduced from Germany into Sheffield, by a person named Waller, a little more than a century after, and, being much made by one Huntsman, was called Huntsman's cast steel.

Steeple, (*steopel*, *stypel*, Sax.) an appendage generally erected at the west end of churches, to contain the bells, and rising either in form of a tower or of a spire.

Stele, (Gr.) the same as *Cippus*.

Steps, the degrees in ascending a stair-case, which are composed of two parts, the *tread* or horizontal part, and the *riser* or vertical part. Steps round the circumference of a circle are called *winders*, and when they proceed straight forwards, *flyers*.

Stereobate, (Gr.) the bases or foundation, from which a wall, column, or building rises.

Stereographic Projection, that projection of the sphere in which the eye is supposed to be placed in its surface.

Stereography, (Gr.) that part of the geometry of solids, which demonstrates their properties, and shows their construction. A work on perspective, by Mr. Hamilton, is entitled *Stereography*.

Stereotomy, (Gr. *στερεος*, *solid* and *τομη*, *section*,) the branch of stereography which teaches us to cut solids under certain specified conditions.

Stern, the hindermost part of a ship.

Sterlings, see *Stilts*.

Stiles, (*stigele*, Sax.) the vertical parts of a frame.

Stilts, (*stælan*, Sax. *supporters*,) piles driven in the ground, to support the pier of a bridge, used formerly when the bed of the river could not be laid dry, and surrounded by a row of piles and planks, fixed at a short distance from them, somewhat in the manner of a coffer-dam, which was termed a *stirling* or jettee, and the space between filled with loose stones.

Stoa, see *Athenian Architecture*.

Stock, a tool for boring wood, with a crank, so contrived as to rest with one end against the breast of the workman, while with one hand he holds the boring end steady, and with the other turns the crank. The steel borers are called *bits*, and the whole instrument is commonly called a *stock and bit*.

Stone, (Saxon,) the substance which is employed in the erection of all magnificent edifices, which are intended at the same time to possess durability. Various kinds are employed, which receive their different names either from the substances which are found in their composition, or from the places where they are quarried. Modern masonry is confined more to the working in freestone than in marble, as in the former our islands every where abound. Portland freestone is the common stone made use of by masons in London, as its hardness gives it many requisites to produce exquisite masonry. Of late, however, the Gloucestershire stone has come into great use, owing to its comparative cheapness, but Portland stone will be always preferred for internal work, on account of its superior neatness. Portland stone is brought from the island of Portland, in Dorsetshire, and highly esteemed for building, especially in London, and forms the chief material in public buildings. In erections of brick, and common dwelling-houses, the ornamental parts are of this stone. It is a stone of a compact and beautiful appearance, but fails to support great pressure: as it comes out of the quarry, it is soft, and worked with ease, but by exposure to the air it becomes very hard and durable. The island of Purbeck, in Dorsetshire, produces the stone called Purbeck stone, which is suited to the rougher workmanship of paving, and for steps; and where greater strength and durability are required, the Yorkshire stone is chiefly used, for copings and outside work, and frequently for paving. Hearth stones and slabs are made of Ryegate and other similar stones. Scotland produces abundance of stone of the best kinds for building, and particularly the Craigleith stone, from a quarry in the neighbourhood of Leith; and a good stone is also brought from Hail's quarry. Two kinds of stone are brought from Craigleith, one of a fine cream colour, dug out of the rock called liver rock; this is distinguished by its property of remaining unchanged, even after having been a long time exposed to the weather. The Possel stone, and that from the Lord President's quarry, are from the city of Glasgow: other building stones from Scotland are of inferior quality, change their colour, and yield to the effects of exposure to the weather. For hewn work, requiring squared, or squared and smoothed stones, those chiefly used are sand or lime stones. The sandstone of the north of England is generally of a reddish colour; a very fine sand-stone is, however, found in the neighbourhood of Liverpool. Lime predominates in the composition of the stones of the south and west of England, which are worked with ease, and harden by exposure to the weather.

In all works which require great solidity and wear, the granites of Cornwall, and the Dundee stone, or Scotch granite, are now generally employed; their excessive hardness has made it necessary to bring to London the workmen as well as the stone, as there were found in London no persons who would undertake to work it. It has been chiefly used in the docks and new bridges. Granite, being a compound silicious rock, varies much in the proportion of its constituent parts, but it may be considered as forming a durable building stone. Those granites, however, which contain much white felspar, and only a small portion of quartz, like the greater part of the granites of Cornwall and Devonshire, are liable to decomposition much sooner than some of the Scotch granites, in which the quartz is more equally and abundantly disseminated. That species of granite, called syenite, was extensively quarried by the

Egyptians at Siene, in Upper Egypt, and afterwards by the Romans, and many works constructed of it preserve the marks of the chisel fresh to the present day. In the naval hospital at Plymouth, the granite, which is from Cornwall or Devonshire, appears to have been well selected, since, after a period of seventy years, it exhibits no symptoms of decay, except in the columns of the front, where the felspar is already disintegrating. The felspar in the Cornish granite contains a large portion of potass, and to this its more rapid decomposition may be ascribed.

Some of the sand-stones in the secondary strata are composed of grains of silex, and are often almost as durable as granite. Some of these, however, which appear to have been of alluvial formation, have their parts so loosely cemented, as to be totally unfit for building. Some of the lowest beds in Derbyshire and Yorkshire, which are commonly called mill-stone grit, are almost purely silicious; and the stones of Kirkstall abbey, which is now in ruins, are of this kind, and where they remain, after a period of six hundred years, they preserve their angular sharpness as fresh as if they had just been worked. A quarry is still worked in the neighbourhood. It may be observed, that, in general, purely silicious stones are the least liable to decay, but when they are mixed with other substances, no one but a skilful mineralogist is able to judge which are the most appropriate for durable architecture.

Argillaceous and basaltic stones are ill suited for building: in their native beds they are often found so extremely hard, as to make it impossible to move them in any way but by blasting; yet when they have been for a few months exposed to the air, they become soft, and shiver into small pieces; yet there are some basaltic stones, which appear more perfectly vitrified, and which will resist the action of the atmosphere for ages. Lavas are nearly allied to basalt, and some of them rapidly decompose, and form a fertile soil, while others remain unchanged for centuries. In the West Riding of Yorkshire, where argillaceous sand-stone is frequently used in mending the roads, they are soon reduced to mud.

Under the head of calcarious stones are comprised the several sorts of lime-stone, from marble to chalk and calcarious lime-stone. That marble or lime-stone which is found in primitive mountains, among blocks of granite, gneiss, and mica-slate, is generally the most durable, as it is highly crystalline, and frequently contains silicious earth. Such as contain calcarious earth combined with magnesia, are of a milky whiteness, and, when they have an uniform texture, are very durable. The edifices and the statues of ancient Greece, (among the latter of which may be enumerated the Medicean Venus, the colossal Minerva, known by the name of the Pallas of Veletri, the Diana Venatrix, and the Juno Capitolina,) which are of Parian marble, have retained for ages the original polish. This marble has somewhat the appearance of wax when polished; it receives the most delicate touches of the chisel, and hardens by exposure. The marble of mount Pentelicus, near Athens, was intersected with veins of extraneous matter, which in some instances appear more than in others. Dr. Clarke remarks, that while the works executed in Parian marble remain perfect, those of Pentelic marble have been decomposed, and sometimes exhibit a surface as earthy and rude as common lime-stone. Of English marbles by far the most beautiful are those of Devonshire, particularly the marbles found at Babicomb, which are veined, and spotted with a variety of colours. The Plymouth break-water is composed of immense blocks of marble from the Cat-Down quarries. That called Anglesey marble is chiefly pure serpentine. Such of the secondary lime-stones as contain a considerable quantity of magnesia, which are particularly found in Nottinghamshire, Durham, and Yorkshire, where they are said to have been used in building the York Minster, are very durable. The roe-stones of Portland and Bath, though much used, are far from durable, and when used in ornamental work, the fine chiselling is soon effaced by the atmosphere.

The loose texture of chalk, and the generality of magnesian stones, render them of little use in building. Alabaster or gypsum is sometimes employed, but it is peculiarly improper for any situation that is exposed to rain or water. Alabaster resembles marble in taking a fine polish, but is much softer and more easily worked. The ancients procured it from the district of Upper Egypt, which lies between the Nile and the Red Sea, and from Syria and Carmania.

A stone dug in the hills near Dunstable, and called Tottenhoe stone, from the parish in which it is found, has the appearance of indurated chalk, is easily worked, and hardens by exposure, but is liable to be injured by frost, particularly when in contact with the ground. This was the stone chiefly employed in the house of the duke of Bedford, at Woburn Abbey; and the present condition of many old churches, which have been built with it, in those parts, is a proof of its durability.

Whin and schistus are used in rubble work. The former, dressing freely with the hammer in one direction, may readily be formed with good faces, but not being stratified, their beds are uncertain, and not easily improved by art. Schistus is just the reverse, having naturally good beds, but is in few instances capable of being dressed square across the layers, or laminæ. Those stones, in general, which are the hardest, and the most compact and uniform in their texture, and which can be brought to the smoothest surface, are the least liable to decomposition and disintegration. Those stones which, when immerged in water, absorb the smallest quantity, and which are the least changed by the action of heat or of acids, may be depended on as those which will resist longest the effects of the atmosphere. It is now a common practice to rub with oil the calcarious sand-stones, and this must in a considerable degree contribute to its durability, by resisting the absorption of water.

Modern architects have been remarkably injudicious in their choice of stones. It has been observed, that "in modern Europe, and particularly in Great Britain, there is scarcely a public building of recent date which will be in existence a thousand years hence. Many of the most splendid works of modern architecture are hastening to decay, in what may be justly called the very infancy of their existence, if compared with the date of public buildings that remain in Italy, in Greece, in Egypt, and the East. This is remarkably the case of the bridges of Westminster, and Blackfriars, the foundations of which began speedily and visibly to perish in the very life-time of their founders. The same observation is applicable to Somerset-house, and many other public buildings in London: the fine chiselling of the *alto-relievo* figures have already disappeared by the action of the elements mouldering away the stone. The most careless observer may notice, that this effect is more rapidly taking place in some stones than in others, though they are all of Portland stone, a calcarious stone, called roe-stone by mineralogists, and obtained from the isle of Portland."

The following is a table of the specific gravities of the different kinds of stone, compared with that of metals.

Stones.

Pyrites	4954
Ruby	4283
Garnet	4189
Topaz	4011
Sapphire	3994
Beryl	3549
Diamond	3521
Lime-stone	3179
White Glass	2892
White Razor-hone	2876
Basalt	2864
Chalk	2784
Chrysolite	2782
Emerald	2775
Porphyry	2765
Marble	2742
Bottle Glass	2733
Alabaster	2730
Pearl	2684
Slate	2672
Pebble	2664
Red Egyptian Granite	2654
Crystal	2653
Green Glass	2642
Agate Onyx	2638
Spar	2595
Flint	2594
Beryl	2545
Common Stone	2520
Paving Stones	2416
Gypsum	2168
Opal	2114
Brick	2000
Amber	1078

Metals.

Hammered Platina	20337
Purified Platina, not hammered	19500
Crude Platina, in grains	15602
Gold, hammered	19362
Gold, pure, melted	19258
Gold, Guinea	17629
Mercury, solid	15632
Mercury, fluid	13568
Lead, melted	11352
Lead, Cubic ore of	7587
Virgin Silver, hammered	10511
Virgin Silver, not hammered	10477
Coinage Silver	10534
Brass, cast, not hammered	8396
Hardened Steel	7840
Steel, neither tempered nor hardened	7833
Nickel, melted	7807
Copper	7788
Iron Ore	7355
Cast Iron	7207
Cornish Tin, melted	7291
Hardened Tin	7290
Zinc, melted	7191

An ingenious paper by Mr. Treadgold, on the flexibility and strength of stones, was published in the Philosophical Magazine. In making his experiments, he supported the piece of stone at each end upon iron supports; the scale for the weights was suspended from the middle between the supports; and a silken line attached to the middle, moved a lever index, which multiplied the depression so as to render a very small quantity visible. The scale and its apparatus weighed ten pounds; the weights used were cubical pieces of iron cast on purpose, weighing ten pounds each. A piece of white statuary marble of a very regular texture, free from veins, or other apparent defects, was tried at three different lengths, the short specimens being fragments of the long one. The piece was not perfectly uniform in breadth and depth, but the dimensions of the places of fracture are given; the specific gravity of the marble was 2,706, and it absorbed $\frac{1}{1500}$ of its weight in water.

Distance between the supports 30 in. Depth 1,075 Breadth 1,075		Distance between the supports 15 in. Depth 1,08 Breadth 1,05		Distance between the supports 14 in. Depth 1,075 Breadth 1,075	
Wt.	Depression.	Wt.	Depression.	Wt.	Depression.
lb.	in.	lb.	in.	lb.	in.
10	,02	10	,005	10	not sensible.
20	,045	20	,01	20	,005
30	,06	30	,012	30	,01
40	,08	40	,015	40	,012
50	broke.	50	,017	60	,015
		60	,02	70	,02
		70	,021	90	,025
		80	,025	100	,027
		90	,03	110	,03
		100	,035	120	,034
		110	broke.	130	,037 and broke.

There is some difference in the quality of the Portland stone used in London: the best and strongest kind is of a browner colour than the rest. With a piece of this, of a regular texture, and apparently without defect, the following experiments were made. The length between the supports was 24 inches, the breadth two inches, and the depth 1,45 inch. The specific gravity of this stone was 1,113, and it absorbed $\frac{1}{16}$ of its weight of water.

Weight.	Depression.
lb.	in.
10	,01
20	,015
30	,02
30	,022
40	,025
60	,0275
70	,03
80	,032
90	,035
100	,037 and broke.

The next trial was made with a piece of white silicious sand-stone from Lord Keith's quarries, at Long Annet. Its specific gravity was 2,212, and it absorbed $\frac{1}{276}$ of its weight in water. Its texture was regular with small scales of mica distributed through it. The distance between the supports was 18 inches; the breadth 1,45 inch, and the depth 1,525 inch.

Weight.	Depression.
lb.	in.
20	,015
30	,02
40	,022
50	,025
60	,03
70	,038
80	,045
90	,05
92	broke.

The following table contains the results of experiments on the lateral strength of stones, in which the flexure was not ascertained. With the exception of one of those from Long Annet, they were laid with their natural beds horizontally. The specific gravity of the Dundee stone was 2,621, and it absorbed only $\frac{1}{511}$ of its weight of water: that of the Craigleith stone 2,362, and it absorbed $\frac{1}{63}$ of its weight of water.

Kind of Stone.	Distance between supports.	Bdth.	Dpth.	Wt. that broke it.	Wt. of the cubic foot.
	in.	in.	in.	lb.	lb.
Dundee Stone ..	14	1,45	1,5	414	163,8
Craigleith Stone ..	14	1,55	1,55	137	147,6
Hailes Stone ..	14	1,55	1,5	123	134,6
Long Annet Stone	9	1,525	1,45	166	138,25
—another specimen	7	1,55	1,55	233	——
Portland Stone ..	12	2,07	1,55	270	132,
Bath Stone ..	5,5	1,	1,	58	123,4

The Dundee stone was from the Mylne-field quarry, near Dundee; but the specimen used in the above experiment was superior to those usually obtained from that quarry.

STONEHENGE, a celebrated temple of the ancient Druids, in Wiltshire. The area of this monument is surrounded by a ditch 369 yards in circumference, and a slight agger of earth. The only entrance appears to be that which faced the north-east, and is marked by a bank and ditch called the *avenue*, which leads directly into it. The first object on this side, as we approach, is a large rude stone, in a leaning position, which has received the name of the Friar's heel, from an idle tradition connected with it. The temple consists of two circles and two ovals; the two latter constituting the *cella* or *sanctum*. The outward circle, about three hundred feet in circumference, is composed of huge upright stones, bearing others over them which form a kind of architrave. They evidently show the mark of tools, but are irregular in their forms and sizes. The height of the stones on each side the entrance is a little more than thirteen feet and the breadth of one seven feet, and of the other six feet four inches. The inner and grander part of the temple, the *cella*, represents two-thirds of a large oval, and a concomitant small oval, as in the outward temple we find a large and a small circle. The larger oval is formed by five pair of trilithons, placed in pairs, and increasing gradually in height from east to west, the smallest being sixteen feet three inches high, and the highest twenty-one feet six inches high. From examining those which are standing, and comparing with them those that are fallen, we find that a great deal of regularity pervaded the plan of this building and the approach to the altar was rendered more striking by the trilithons rising gradually as you advanced towards it. The inner oval consisted originally, according to Dr. Stukeley, of nineteen stones; but only eleven now remain. They are much smoother and taller than those of the inner circle of small stones, and incline to the pyramidal form. The most perfect is seven feet and a half high. One of these stones has a groove cut all down it, but for what purpose no conjecture can be found; it varies also in shape from the other, and bevels off almost to an angle on the inner side. The altar stone is fifteen feet long, and almost totally covered by the fall of one of the large upright stones and its impost across it. The inside diameter of this whole building is about one hundred feet, and the width of the entrance into the cella forty-three: the distance from the altar-stone to the entrance into the temple fifty-seven feet 4 inches. Many fragments of Roman pottery, and British antiquities, have been discovered at different periods, in digging within the area, which, from the situations in which they were found, prove the building to have been there at the time the Romans had possession of this island. Stukeley tells us, that a tablet of tin was found there in the time of Henry VIII., inscribed with many letters, but in so strange a character, that the most learned antiquaries of the age could make nothing of it. Some have called it Punic, others Irish; and the doctor says "it was no doubt a memorial of the founders, written by the Druids." The *avenue* is a narrow strip of land, bounded on each side by a slight agger of earth. It issues from the north-east entrance of the temple, crosses the turnpike-road, and proceeds in a straight line towards a valley, where it divides into two branches, one leading in a gentle curve to what is called the *circus*, and considered to have been the race-course of the ancient Britons, the other proceeding in a direct line up the hill, between two rows of barrows, planted with fir trees.

A view of Stonehenge is given in plate *Athenian Architecture*, A 6.

In the same county, at Abury, is another remarkable druidical temple. Stukeley, who examined the temple at Abury when it was in much better preservation than at present, observes, "that the whole figure represented a snake transmitted through a circle." "In order to put this design in execution, the founders well studied their ground; and to make their representation more natural, they artfully carried it over a variety of elevations and depressures, which, with the curvature of the avenues, produces sufficiently the desired effect. To make it still more elegant and picture-like, the head of the snake is carried up the southern promontory of Hackpen hill, towards the village of West Kennet; nay, the very name of the hill is derived from this circumstance;" for *acan*, he observes, in the Chaldee signifies a serpent, and *hac* is no other than a snake: in Yorkshire they still call snakes *hags*: *pen* in the British language signifies a head. (History of Abury, p. 32.) Dr. Stukeley then observes "that the *dracontia* was a name amongst the first learned nations for the very ancient sort of temples of which they could give no account, nor well explain their meaning upon it. It is well known that the serpent was held in great veneration by the ancients; and temples were constructed in the form of that animal, and designated by this name (*dracontia*) and Stukeley supposes that an allusion is made to a similar temple by Pausanias, where he says, that on the road from Thebes to Glisas was a place surrounded by stones, which the Thebans called the *serpent's head*, (οφεως κεφαλην,) and the same writer, in his Corinthiaca, mentions another circle of stones on the river Chimarrus. The form of the temple at Abury may be briefly stated as consisting of a grand circle, comprehending within its area two smaller concentric circles; the avenue to the village of Kennet terminating with another circle, supposed to indicate the head of the serpent, as the large circle indicated the body, and also the Beckhampton avenue, which alluded to the tail of the same animal. Between the extremities of the two avenues, exactly south of Abury, stands the vast tumulus of Silbury hill. (See Hoare's Ancient Wiltshire, Stukeley's Stonehenge and Abury, and "The Celtic Druids" by Godfrey Higgins.)

A fine druidical work, consisting of an open temple of a circular form, made of rough stones set upright in the ground, is found at Bowldrich in Oxfordshire. In the neighbourhood are several barrows. In Westphalia and East Friesland are very curious druidical monuments. In one near Drontheim, of which a view is given by Keysler (Antiq. Septent. p. 6,) the stones are from sixteen to twenty-five feet long, and from four to six thick, and the superincumbent stones from twenty to fifty in circumference. He also describes one on the top of a mountain near Helmstadt. At Classerniss, in the Scotch isle of Lewis, is a very fine druidical temple, consisting of an avenue and a circle, with a stone in the middle thirteen feet high, in the perfect shape of the rudder of a ship. (See Borlase,—Toland's Hist. Druids — Maculloch's Western Islands.) Mr. Hoare has given two plates of very curious *cromleeks* discovered in Malabar, which bear a striking resemblance to those found in Britain. Clarke, describing the hill of Kushunlu Têpê, near Gargarus, in the Troad, observes, that all the way up may be noticed the traces of former works, but upon the summit there is a small oblong area, six yards long and two broad, exhibiting vestiges of the highest antiquity; the stones forming the enclosure being as rude as those of the Tirynthians in Argolis, and the whole encircled by a grove of oaks, covering the top of this conical mountain. The entrance to this area is from the south. Upon the east and west, outside of the trees, are stones ranging like what we in England call druidical circles.

There are at least three circles of stones known in America. One stands upon a high rock, upon the banks of the river Winnipigon. The Indians are accustomed to crown this circle of stones with wreaths of herbage and with branches. A very fine cromlech, resting upon the apices of seven small conical pillars, still exists at North Salem, New York. The horizontal stone is ten feet broad. Rocking stones, rock idols, barrows, &c. are also found. Hodgson's Letters from America. See *Druidical Architecture*, and *Pierres Leveés.*

The following terms often occur in describing druidical remains. *Cistvaens:* Three or four stones placed edgeways, covered by another at top, found under barrows. *Cromlechs*, or *cromlechs;* flat or round stones standing upon others, like a table tomb. *Garseddau*, a copped heap of stones, upon which the arch-druid is supposed to have sat in judgment; adjacent to it was a *Brin-gwyn*, or circular hollow, surrounded with an immense agger, a stone circle, and cromlech. *Maen-Hir*, *Meini Horion*, or *Meini-Gwyr*, large stone cippi, set upright, sometimes two or more adjacent, as British pillars of memorial. *Maen-sigl*, rocking stones. *Tolmen*, stones with holes therein, through which it has been supposed that diseased persons were drawn in order to be cured.

Story, (*stor*, Sax. *place*,) a floor, a flight of rooms.

Story-Posts, upright timbers, used in sheds, workshops, and old wooden houses, to support the floors, or superincumbent walls.

Story-rod, a rod equal in length to the height of a story of a house, and divided into as many parts as there are intended to be steps in the stair, for measuring and laying them out with accuracy.

Stoup, a basin for holy water, in a niche at the entrance of a Catholic church.

Stove, (*stoa*, Icelandic, a fireplace.) The most common way of warming rooms among the Romans was by the *hypocaustum*, (see this word.) Of late years numerous improvements have been made in stoves. The stove invented by Franklin was very ingenious, and the principle is much in use among the French. He completed his first stove in 1771, and while he was in France he contrived another grate for burning pit-coals, which has the same property of burning the smoke, and at the same time the fire is exposed in a grate. The grate is a short cylinder, with its axis placed horizontally, and the end turned towards the apartment, one of its circular ends being made with bars, and the other being a back-plate. The whole of the cylindrical grate turns upon pivots fixed in the opposite sides, across the centre of it. Mr. Sharp took out a patent for an improvement and simplification of this grate, of which he published an account. The true *German* stove is made like a box, one side wanting, and that side is built against the side of the room, the fuel being put into it from another room, or from the outside of the house: it warms a room speedily and thoroughly with little fuel, no quantity of cold air coming in at any crevice, because there is no discharge of air which it might supply, there being no passage into the stove from the room. Mr. John Cutler of London, had a patent in 1815, for an important improvement in those fire-places, which are termed *register stoves.* Mr. Cutler's stove is made of cast-iron plate enclosing the fire-place at the back and side, and open in front, leaving only a passage for the smoke through a register, at the upper part of the enclosed space. A chamber or magazine is placed beneath the grate in which the fire is to burn, containing sufficient fuel to supply the combustion for a whole day, and so contrived as to elevate a portion of fuel from time to time into the grate, without the trouble of throwing on coals. An improved kitchen fire-place, invented by John Craigie, is described in the Repertory of Arts, vol. 17., second series, 1810. Tubular flues constructed of bricks of a peculiar form, have been invented by John Hiort of Whitehall office of works: its peculiar advantages, are an improved draft; not becoming foul by adherence of soot so soon as other flues of chimneys, and the ease with which it may be cleaned by mechanical means. It is described in the Repertory of Arts, vol. 3. third series, 1825.

An invention by J. Parks of Warwick, of a new and improved method of lessening the consumption of fuel, and for consuming smoke, particularly in furnaces and steam-engines, is recorded in the first volume of the London Journal of Arts, p. 401. In the same volume (p. 405,) is described an improved economical fire-grate by Mr. Brunton of Birmingham.

Great improvements have likewise been made in hot-house stoves. But the most important of all the recent improvements in hot-houses, is the use of steam. The advantage arising from it is that an equal temperature can be maintained for a length of time with great ease and certainty, and the plants can scarcely ever be liable to suffer a scorching heat. It has been found also by experience that seven bushels of coal go as far in keeping up steam-heat, as ten bushels do in maintaining an equal temperature the other way. It happens too, fortunately, that steam apparatus may be easily applied to the common hot-house; a boiler being erected over the usual furnace, the smoke of which passes through the flues as formerly. Metal pipes (generally copper) are laid along the top of the brick flues. The boiler, as in the common steam-engine, is supplied from a cistern above, and is made to regulate itself by a simple contrivance. In the feed-head is a valve which is opened by the sinking of a float, which descends in proportion as the water is dissipated by steam, and being balanced by a weight, whenever a sufficient quantity of water is admitted, rises again, and shuts the valve. A safety-valve is added, loaded according to the strength of the boiler, and another valve for admitting atmospheric air.

Straight-jointed Floor: when the joints of a floor are continued from one end to the other, and the heading joints are not in the same straight lines as folding floors, this term is applied to it.

Straining Piece, or *Strutting Piece*, a beam placed between two opposite beams, to prevent their nearer approach, as rafters, braces, struts, &c. When it serves both as a straining piece and a sill, it is called a *straining sill*.

Strap, (*stroppe*, Dutch,) an iron plate, to secure the junction of two or more timbers, into which it is secured by bolts.

Strength of Materials, see *Mechanical Carpentry*. The following are the results of experiments and calculations, as given in the article *Strength of Materials*, in Rees' Cyclopædia, in which W is the computed weight, and D the angle of deflection.

" The centre of tension and centre of compression are nearly, or exactly, coincident with the centre of gravity; and the neutral line, whatever may be the figure of the section, is so posited, that the rectangle of the area of tension into the distance of its centre of gravity from the said line, is to the rectangle of the area of compression into the distance of its centre of gravity, as 1 to 3.

" From which theorem, the neutral line for any formed beam may be determined, and the absolute strength may then be found as follows, viz. let *d* denote the distance of the centre of tension, and *l* the length of the beam, all in inches; D the angle of deflection, and *f* the strength of direct cohesion on a square inch; then, without considering the increased length of lever:

1. When a beam is fixed at one end,

$$W = \frac{2fad}{l.\ \cos.\ D.}$$

2. When the beam is supported at both ends,

$$W = \frac{8fad}{l} \times \cos.\ D.$$

3. When the beam is fixed at both ends,

$$W = \frac{12fad}{l} \times \cos.\ D.$$

And when the beam is fixed at one end at any angle, formula I will still apply; only increasing or decreasing the angle of deflection by the quantity of the first angle of inclination, according as that inclination is downwards or upwards.

" And when the beam is supported, or fixed, at both ends, and either resting obliquely, or acted upon by an oblique force, the two latter formulæ become,

4. For the beam supported at each end,

$$W = \frac{8fad}{l} \times \frac{\cos.\ D}{\cos.\ I}.$$

5. For the beam fixed at each end,

$$W = \frac{12fad}{l} \times \frac{\cos.\ D}{\cos.\ I.};$$

Where I denotes the angle, which the direction of the force makes with the direction of the beam.

" *Note* 1.—It should have been observed, that the preceding theorem for determining the neutral line, is principally drawn from experiments on fir-beams. A different ratio than 1 : 3 may be necessary in other kinds of wood, but at present that ratio has not been found.

"*Note* 2.—The deflection D, as we have before observed, is not a necessary datum in estimating the strength of timber, for any practical purposes of building, &c. it is merely introduced in order to reconcile the theory with the result of experiments made upon the absolute and ultimate strength, in which cases, particularly in long beams, it becomes an important quality, and must not be omitted; and in all cases where it is required, it must be drawn from some prior experiment on the same kind of wood, by means of the following theorem, *viz.*

"Let l, d, D represent the length, depth, and deflection of any beam; l', d', the length and depth of any other beam, whose deflection, D′, is required; then

$$D' = \frac{l' d D}{l^2 d'}$$

"*Example* 1.—*The strength of direct cohesion on a square inch of fir being* 13,000lbs. *required the weight necessary to break a rectangular bar,* 30 *inches long,* 2 *inches deep, and* 1 *inch in breadth, when fixed at one end in a wall, and the weight acting at the other; the deflection, computed from other experiments, having been found to be 5 inches.*

"First, find the neutral line: here, since the section is a rectangle, the centre of tension and compression are each on the centres of their respective areas, therefore call the depth of tension x, the depth of compression will be $2 - x$, which also denotes these areas; and we must have, therefore,

$$\frac{x^2}{2} : (2 - x)^2 :: 1 : 3;$$

or $3x^2 = 4 - 4x + x^2$ or $x^2 + 2x = 2$. Whence $x = -1 + \sqrt{3} = ,732 = a$

also $\frac{,732}{2} = ,366 = d$;

tan. of deflection $= \frac{5}{30} = \frac{1}{6} = ,16666666.$

Where the angle D = 9° 34′, and its cosine = ,9860; therefore, by formula 1,

$$W = \frac{2fad}{l.\cos.D} = \frac{2 \times 13000 \times ,732 \times ,366}{30 \times ,986}$$

= 235lbs.

"*Example* 2.—*Required the weight that would break the same beam, when supported at each end, rejecting the deflection, which is very inconsiderable.*

"By formula 2,

$$W = \frac{8fad}{l} = \frac{8 \times 13000 \times ,732 \times 366}{30}$$

= 928lbs.

"*Example* 3.—*Required the weight that would break the same beam, fixed at each end.*

"Rejecting the deflection, we have, by formula 3,

$$W = \frac{12fad}{l} = \frac{12 \times 13000 \times ,732 \times 366}{30}$$

= 1492lbs.

Note.—We have assumed 13000 for the force of direct cohesion; this, however, rather exceeds the greatest strength of fir, which varies from 10000 to about 13000lbs.

"*Example* 4.—*Assuming the direct cohesion at* 13000, *and the specific gravity of fir at* 720; *how long must a beam be, that is* 2 *inches deep and* 1 *inch broad, which, when fixed with one end in a wall, will just break with its own weight?*

"Let x be the required length of the beam in inches; its weight will be $\frac{2x \times 720}{1728}$ ounces, or $\frac{90\,x}{1728} = \frac{5\,x}{96}$ pounds; and this weight will have the same effect as if it acted all at one point on the centre of the beam, or at the distance $\frac{1}{2}\,x$.

"Hence, by substituting $\frac{5\,x}{96}$ for W, in formula 1, we have $\frac{5\,x}{96} = \frac{2 \times 13000 \times ,732 \times ,366}{\frac{1}{2}\,x}$; or $5\,x^2 = 192 \times 2 \times 13000 \times ,732 \times ,366 = 133728$; whence $x = \frac{\sqrt{133728}}{5}$ inches, or 47 feet.

"In this case the angle of deflection is not introduced.

"When the deflection is considered, as it should be in this case, we find it to be, from the data of example 1, and the theorem for the deflection, as $30^2 : 5 :: \frac{1}{2}\,x^2 : \frac{5\,x^2}{3600}$; whence the cos. $= \sqrt{\left(1 - \frac{25\,x^2}{(1800)^2};\right)}$ and the above equation becomes $\frac{5\,x}{96} = \frac{2 \times 13000 \times ,732 \times ,366}{\frac{1}{2}\,x\sqrt{\left(1 - \frac{25\,x^2}{(1800)^2}\right)}}$; which produces a cubic equation, whence the value of x may be determined.

"Mr. Banks, after many experiments made, at various times, on the real and comparative strength of oak, fir, and iron, has deduced the following inferences: the worst, or weakest, piece of dry heart-of-oak, one inch square, and one foot long, bore 660lbs., though it was much bent, and 2lbs. more broke it. The strongest piece he tried, of the same dimensions, broke with 974lbs. The worst piece of deal bore 460lbs.; but broke with little more. A bar of the weakest kind of cast iron of an inch square and a foot long, would break with 2190lbs."

Stretching Course, bricks or stones laid in a wall with their longest dimensions in the horizontal line.

Striæ, (*stria*, Lat. a furrow,) the name given by the Romans to the lists or fillets which separate the flutings of columns.

Striated, chamfered, or channeled.

Strigæ, the Latin name for the flutings of a column.

Striking, a term used for drawing lines on the surface of a body. *Striking a centre*, is the removal of the woodwork after the completion of the arch.

String-board, a board placed next to the well-hole in wooden stairs, and terminating the ends of the steps. The *string-piece*, is the piece of board put under the flying steps for a support, and forming, as it were, the soffit of the stair.

String course, a narrow moulding continued along the side of a building.

Struts, oblique framing pieces, joined to the king-posts, or queen-posts, and the principal rafters;—they are sometimes called braces.

Strut Beam, an old term for the collar-beam.

Strutting Piece, see *Straining Piece*.

Stucco, a term indefinitely applied to calcarious cements of various descriptions. The *chunam* stucco, or maltha, of India, is an invention of great celebrity and of ancient date. This composition is made by mixing with fifteen bushels of newly slacked lime, an equal quantity of pit-sand, and leaving the mixture at rest for three days. In the mean time twenty pounds of molasses must be dissolved in water, and a peck of a kind of pea called *gramm*, is to be boiled with a peck of mirabolans, till the whole be reduced to a jelly. Incorporate the three ingredients intimately, and beat up to the consistence of a very fluid cement, with as much of the sand and lime as necessary for the purpose; after which mix into it a small quantity of short tow, and it will be fit for use. When the workman leaves off, for even a short time, some of the gelatinous composition, without the lime, must be spread over the place where the work is to be continued from. The whites of four eggs, and four ounces of butter-milk, are to be added to each half-bushel of the composition, when intended to be used as stucco; but it must be added at the time it is used. See *Mortar*, *Albarum Opus*, and *Tectorium*.

The most common stucco is composed of pulverized white marble mixed with plaster of lime, the whole sifted and wrought up with marble. Architectural and sculptural ornaments, such as fruits, flowers, garlands, festoons, &c. are made with this composition. Immediately when the stucco is mixed, it forms a very soft and ductile paste, the consistence of which, however, soon hardens, and then the desired form is given to it, either with moulds, or, in some cases, with a little spatula of iron. During this operation it continues to harden, and may even be cut, and at this period those parts of the ornaments may be executed which demand a nice finish. In time it becomes as hard as stone, and takes a beautiful polish. Vitruvius appears to make mention of stucco, in the second, third, and sixth chapters of his seventh book under the name of *Opus Albarium*, or *Opus Coronarium*. The most eminent artists in this branch have been,—Margaritone, who died in 1317, and is generally considered as the inventor of the art; Barthelemi Ridolfi, who died about 1550; Giovanni Nanni, died 1564; Leonard Ricciarelli, died about 1570; Luca Romano, about 1586; Arudini and Branchi, about 1640; Roncaioli, 1660; G. F. Bezzi, 1690; G. B. Artario, about 1700; G. B. Genone, 1700; A. Disegna, 1710; S. Busi, 1730; A. Stazio; M. Costa; Clerici, 1745; C. Mazzetti, 1750; G. Artario, 1769. The following works may be consulted on this subject:—J. A. Corvinus, Artis Sculptoriæ, Vulgo Stuccatoriæ, Paradigmata, Aug. Vin. 1708; J. Melchior Croeker, in his Instruction à l'Usage des Peintres; Montamy, in his Traité des Couleurs pour La Paintre en Email; Appeal on the Right of using Oil Cement or Composition for Stucco, 8vo. 1779.

Studs, (*studes*, Sax. a post,) a term applied to posts or quarters, which are placed in partitions about a foot distant from each other.

Stud-work, a wall of brick-work built between studs.

Stylobate, or *Stylobatum*, (Gr.) a term used by Vitruvius to signify the whole uninterrupted basis below the columns: it means a plane surface raised either upon a certain number of steps, which were continued all round, or upon a podium, which afforded no approach but in front.

Subnormal, the distance between the foot of the ordinate, and a perpendicular to the curve (or its tangent) upon the axis.

Sub-plinths, the columns of

Chester-gate, Regent's Park, have bases and plinths, with cubical subplinths of granite beneath them, as if they were too short for their places, and required the aid of such appendages, to raise them to their architraves. This is a fault never found in the pure and sublime architecture of Greece, and rarely in that of ancient Rome, except where they stand as divisions or piers between steps, the column standing on the uppermost, as in Wren's beautiful colonnade at Greenwich Hospital.

Sudatory, (*sudatorium*, Lat.) an apartment in the Roman baths; a hypocaust. In 1753, when the military road leading to Carlisle was made, a curious Roman hypocaust, or sudatory, was discovered about two miles from Newcastle-upon-Tyne; it was situated about three hundred yards south-west of the Roman station *Condercum*, now *Benwall*.

Summer, the lintel of a door, window, &c.; a beam tenoned into a girder, to support the ends of joists on both sides of it; a common term in some places for a girder.

Summer-House, is a little edifice or recess embowered among roses, jesmines, and every variety of beautiful flowering shrubs, in a garden or shrubbery.

Summer-Tree, a beam full of mortises for the reception of the ends of joists.

Sun-dial, Fig. *a* and *b*, *Pl. Ægesta*, are delineations of an ancient sun-dial, still remaining nearly in its original situation, on the rock of the acropolis of Athens; *a a* marks the equinoctial, *b b* the summer solstice, and c c the winter solstice. It appears to be of the same kind as the hemispherium that was invented by Aristarchus the Samian, which is mentioned in the following passage of Vitruvius. "Hemicyclium excavatum ex quadrato ad enclimaque succisum Berosus Chaldæus dicitur invenisse; Scaphen sive Hemisphærium Aristarchus Samius: idem etiam discum in planitia." The following observations on this passage we have translated from Montucla, Histoire des Mathematiques. "The quadrant of Berosus ought first to be considered. We think it must not be considered as a hemispheric cavity, as many authors have described it, but a cavity simply in a hemicycle or cylindric: for the scaphé or hemisphere which we shall describe below, and which has been preserved, was attributed to Aristarchus of Samos. Let us conceive then a square or cubic block of stone, exposed directly to the south, and let us again cut the surface of it so as to be parallel to the axe of the world, or to make with the horizon an angle equal to the elevation of the pole. This is, I think, the sense of the words *ad enclima succisum*, although perhaps it would have been more exact to say *excavatum in quadrato ad enclima succiso*. Trace on this surface, inclined to the horizon, and perpendicular to the equator, a meridian, which may be the axe of a cylindric cavity. It is easy to demonstrate that any point on this axe will describe an arc of a circle like the diurnal arc described in the heavens by the sun. Thus raise at the bottom of this cylindric cavity a style, the summit of which reaches the axe. The shade of its summit will describe on the day of the equinox a semicircle, and every other day an arc similar to that described on the same day by the sun. If then we divide each into twelve equal parts, and draw lines in the cavity of the cylinder lines through the similar divisions of each arc, we shall have the twelve horary lines. It is true that we shall not have the whole of the hours in the long days, for in that case the diurnal parallels ought to exceed the semicircle, and those of the short days would be less. But we may remedy this inconvenience, by prolonging the cylindric cavity in the meridional part, to the horizontal plan.

"This was perhaps the defect of the cylindric quadrant or hemicycle of Berosus, which was succeeded by the hemisphere of Aristarchus of Samos. It is without doubt the most simple, but nothing is more common than to see genius taking the longest road. Let us conceive a hemisphere hollowed in a cubic block of stone, whose base is horizontal. At the bottom of this cavity let there be erected a style whose summit coincides with its centre. A little attention will show that the shade of this summit will describe each day at the bottom an arc of a circle like the parallel diurnal described by the sun. It will then be easy to describe there the equator and the two tropics. We may divide each into twelve equal parts, by drawing curve lines through the equal divisions; they will be the horary lines, and will divide, in twelve equal parts, the track of the style, and the whole day from sun-rise to sun-set.

"I speak continually of the division of the day into twelve equal parts. I ought indeed to observe here, that such was always the case amongst the Greeks and the Romans. The discus that is attributed to Aristarchus of Samos, was probably only the projection of these lines on a plain, tangent to the hemispheric convexity; for this problem certainly does not exceed the capacities of geometers of that period. It is probable also that the scaphé was only the same projection made in a cavity less than the hemisphere. It could only give a few hours after and before mid-day."

What appears to be a representation of the scaphé of Aristarchus may be seen in a bas-relief in the Monumenta Peloponnesia of Paciudi, tom. i. p. 68. See Winckelmann, Mon. Ined. No. 151. Millin. Gal. Myth. pl. clxxi. Several sun-dials still remain at Athens. Among the "Engravings of Statues, &c. at Ince," (vol. i. pl. 71.) is a spherical Grecian dial, with a head, perhaps of Aristarchus, sculptured under it. Another is preserved at lord Besborough's at Roehampton, and a very elegantly formed one from Asia Minor, has been deposited in the British Musæum, where is also the dial of Phædrus, which is described by Délambre. See Vitruvius, lib. ix. c. 9. Montucla, tom. i. p. 720-3. Visconti, Mémoires, p. 78. See *Heliotropium.*

Sunium, the southernmost promontory of Attica, on which was a temple dedicated to Minerva Sunias, the remains of which are described in the "Unedited Antiquities of Attica." It was constructed with the white marble produced by the neighbouring hills. It is of the Doric order, and had six columns in front. North of the temple, and nearly in a line with its eastern front, were discovered the remains of a Propylæa of the same order and proportions. The exquisite finish observed in the execution of these buildings is a proof of their having been erected in one of the best ages of architecture. The fronts of the Propylæa were in antis. The walls of the peribolus, which embraced the temple within their circuit, were faced externally with white marble, and may be traced along the brow of the eminence down to the shore. The columns of the Propylæa diminish in lines perfectly straight. The metopæ over the central interval are much narrower than the others.

Supercilium, (Lat.) the transverse antepagment of a doorway. It is also applied to the small fillets on each side of the scotia of the Ionic base.

Surbase, the mouldings immediately above the base of a room.

Surbasement, (Fr.) the trait of any arch or vault which describes a portion of an ellipse.

Surface, the side or superficies of a body. A surface, which may be cut by a plane through any given point in the surface, so that the intersection of the plane and the surface may be a curve, is called a *curved surface*. If the curve bend inwards it is a *concave surface*, if outwards a *convex surface*. If each of two straight lines extended from any point of a surface to two other points in the same surface, may be on contrary sides of that surface, or, in other words, if the surface be compounded of the two (concave and convex,) the surface is said to be a *concave-convex surface*. *Cylindric surfaces*, which may be ascertained from two dimensions, are either those of which the right sections are circular or semi-elliptic arcs. As the length of the arc of an ellipse which is not a semi-ellipse cannot be found from the base and height without something more is given, or without some other circumstance respecting it is known, as the length of one of the axes; so the area of a cylindric surface, of which the right section is an arc greater or less than half the perimeter of an ellipse, cannot be found from the length of the axis of the cylindric surface, and the two dimensions of the right section.

Surmounted arches, are those which are higher than a semicircle.

Suspension Bridges.—A new mode of constructing suspension bridges has been recently introduced into Scotland. The chains or rods are placed below, and the weight rests on the rods by means of cast-iron brackets, on which the beams are placed. The rods, which are of chain iron, are bent round the ends of the beam, and fastened with a hoop of iron to prevent springing. Buckling screws are placed on the rods near the brackets, for the purpose of lightening the rods, and raising the beams to the level, so that the whole structure can be adjusted with the greatest ease. From the construction, it will be easily seen that the whole weight or pressure is exerted on the iron rods or wires, in the direction of their length, so that they have no tendency to break or bend in a lateral direction. The amazing strength that this mode of connecting the ends of a wooden beam imparts to it, may be illustrated by a very simple experiment. Let the mechanic take a piece of wood, about two or three feet long, and an inch in diameter; place the ends of it between two chairs or stones, and attempt to stand upon it, and he will find it break almost instantaneously. Let him now take a similar piece of wood, and bend, round the two ends, a pice of wire so much longer than the wood as to allow a small wedge, or wooden pin, two or three inches long, to be placed vertically between the wood and the wire, and he will find that he will be unable to break it, though he leap upon it with all his force. The application of this principle may be seen in all cases where brackets and trussed beams are employed, though it has been seldom, perhaps, carried to the extent which it obviously admits of. See *Bridge*.

SWALLOW-TAIL, a mode of joining two pieces of timber together, resembling that termed *dove-tailing*.

SWALLOW-TAIL, in fortification, a single tenaille, narrower towards the fortified place than towards the country.

SYCAMORE, (*acer pseudoplatanus*,) a large and handsome tree, which is a native of Germany, but thrives very well in England. It is much used by turners.

SYENITE. Pliny, in speaking of the architectural monuments of Egypt, observes that this kind of stone was found in the environs of Syene, and was at first named *pyropœcilos*. "It is of this stone," he says, "that the kings of Egypt caused those stupendous monuments to be erected, called obelisks." As it is known of what species of stone the obelisks are constructed, it is inferred that the *syenite* of the ancients was in reality only a species of granite, which derived its peculiar name from the place whence it was procured. M. Stultz, in describing a rock composed of feldspar and blued-ore, mixed, perhaps, with quartz, remarks that Werner designated it by the name of *lapis sienus*, and that it is precisely the same substance as that of which the beautiful obelisks at Rome are composed. M. de Veltheim, however, observes, that this is a mistake, and shows that there is a material difference between the two stones. The finest relic composed of this granite is the column known by the name of Pompey's Pillar.

SYPHON BRIDGE, see *Bridge*.

SYRACUSE, an ancient city of Sicily, which received its name from the marsh Syraco, on the borders of which it stood. Of the five parts into which it was divided, that called Ortygia is the only one now inhabited, but it has few remains of its former splendour. The temple of Minerva, which is considered to have been one of the most ancient in Sicily, is now converted into a church, dedicated to St. Mary of the columns. The spaces between the columns have been filled up with a modern wall, leaving a portion of each column exposed both within and without the church: the columns and antæ of the pronaos appear in the same way. The old walls of the cella have been perforated with several openings, to connect the nave with the ambulatories. The architecture is Doric, and the columns, originally forty in number, are fluted. The columns of the pronaos are of a greater diameter, and higher than those of the peristyles; they are placed upon bases, and their capitals differ considerably from the Grecian form; hence they must have been introduced subsequent to the building of the temple. Length of the cella thirty-two feet, its length cannot be ascertained, as the posticum has been removed. Height of columns of peristyles 28′ 8″ including capital; diameter 6′ 6″ 04. Height of columns of pronaos, including base and capital, 31′ 0″ 75; diameter 6′ 9″ 3. Few traces of the temple of Diana can be discovered. The part of Syracuse called *Acradina* contains the catacombs, but has scarcely any other monument of antiquity. In the *Neapolis* are considerable remains of a Grecian theatre, which was hewn in the rock. It has three ranges of seats, separated by platforms or galleries, which are connected by staircases. The proscenium is entirely destroyed, and the area and lower tier of seats are covered with earth, and overrun with shrubs and trees. The back part of the theatre overlooks the quarries of Neapolis, which have many very singular excavations in the rock, among which is that, which from its shape has gained the name of the *Ear of Dionysius*: a whisper at the mouth of this grotto is audibly repeated, and the reverberations from the explosion of a musket resemble a loud peal of thunder. It is supposed to have served for a place of confinement, as there are remains of channels cut to receive rings of metal, whose rust is still perceptible. Tradition says it was used by the tyrant whose name it bears. In the quarter called *Epipolæ*, may be traced the foundations of the famous wall with which Dionysius the Elder enclosed the city. Of the temple of Jupiter Olympius, in the city of Olympia, on the river Anapus, now called *Il Fium Alpheo*, only the broken shafts of two columns remain: at the bottom they were plain, above they were hollowed into sixteen flutings.

Systyle, (Gr.) that kind of intercolumniation which had two diameters between the columns.

T.

Taa, see *Chinese Architecture*.

Tabbi, or *Tabbia*, a mortar composed of lime and earth, which forms the substance of the walls of most of the houses of Morocco, and many other Arabian cities. See *Arabian Architecture*. We learn from Livy, that the walls of Saguntum were constructed of earth.

Taberna, (Lat.) It has been supposed by the generality of his commentators, that Horace uses the word *taberna*, not only for what we call a *tavern*, but also for all kinds of shops where idle people were accustomed to meet together for conversation. The bottom of the grand circus, on the outside, amongst the Romans consisted of a range of shops, formed into the most beautiful arcades. The shops of bankers and of all kinds of dealers in money, which Tarquinius the elder built around the forum, were called *tabernæ argentariæ*. The shops of the booksellers were in the street *Argilete*, opposite the Mons Palatinus, and are on that account called by Martial, *tabernæ argiletæ*. After the murder of Virginia by her father, the butchers' shops were destroyed, and in their place new ones were erected, which were named *tabernæ novæ*. By the appellation *tabernæ nivariæ*, the Romans designated the ice-houses, where they preserved ice during the whole year, to cool their wine, &c.

Tabernacle, (Lat. *a tent*,) the temporary edifice used by the Israelites for the performance of public worship until the erection of the temple at Jerusalem. It consisted of an open *court*, containing within it a building, to which the name of *tabernacle* was more properly applied, and which was covered with linen curtains embroidered with various colours. There were in all ten curtains, each of them twenty-eight cubits long, by four in breadth, and five of them being fastened together, they formed two coverings, which covered up the whole of the tabernacle. Over these again were two other coverings, one of them composed of goat's hair, the other of sheep's skins. That part which from its sanctity was called the *holy of holies*, was separated from the rest of the tabernacle by a curtain which was fastened to four pillars, that stood ten cubits from the end. The whole length of the tabernacle was thirty-two cubits, or about fifty feet, and its breadth was twelve cubits, or nineteen feet. The court was one hundred cubits long and fifty broad, and was surrounded by twenty columns, each twenty cubits high and ten broad; these columns were covered with silver, and stood upon copper bases, and were placed at a distance of five cubits from each other, having curtains drawn between them, and fastened by hooks. The entrance, which was at the east end, was twenty cubits wide, and was also covered by a curtain, which, however, hung loose. The name of *tabernacle* is given, in a more general sense, to a canopied stall, or niche; a cabinet or shrine, ornamented with open work; an arched canopy over a tomb. See *Adytum*.

In Catholic churches, the name of *tabernacle* is given to a small edifice in form of a temple, constructed of marble, precious stones, or metal, and placed upon the altar, for the purpose of containing the consecrated vessels, &c. The tabernacle or *pix* in our old churches was a small cabinet for containing the host, &c. It was generally made of gold or silver, and set with precious stones. It consisted of a foot, containing a niche with a door, which finishing with a pediment, had buttresses and pinnacles on the side.

TABLE, or *Tablet*, (Lat.) a flat surface, generally rectangular, charged with an ornamental figure. A table which, projects from the naked of the wall is termed a *raised* or projecting table; when it is not perpendicular to the horizon, it is called a *raking* table; and when the surface is rough, frosted, or vermiculated, it is named a *rustic* table. A *table* of glass, is the original circular plate, before it is cut, of which twenty-four make a case. A *corbel table* is a horizontal ornament used for a cornice in Gothic buildings.

TABLE, WATER, see *Water-Table*.

TABLET, a term used by Rickman, to denote projecting mouldings or strings, among which he includes the cornice and drip-stone. The *tablets* (or shelves) in libraries on which the books were ranged, were called by the Romans *pegmata*, or *plutei*.

TABLING, a term used by Scotch builders to designate the coping of the walls of very common houses.

TABLING, see *Constructive Carpentry*.

TABLINUM, (Lat.) an apartment in the houses of the Romans, which was situated in the narrow part of the atrium, fronting the entrance. Vitruvius does not tell us its exact position, but we may easily perceive that it must have had this situation, because he determines its dimensions by the width of the atrium, and that of the alæ or lateral wings of the edifice, by the length of the atrium. The very proportion which Vitruvius gives the *tablinum*, shows that it was much the same as that which in modern times is termed a *cabinet*. "It is requisite," he says, "to give to the *tablinum* a width equal to that of the atrium, if the latter is twenty feet: if it be from thirty to forty feet, only half of the width of the atrium is given to it, and if the width of the atrium be from forty to fifty feet, it must be divided into five parts, and two of these parts given to the tablinum. Its height to the ceiling ought to be one heighth part more than the width." As Vitruvius makes no mention of its length, but only of its width, it would appear that the form of this apartment was a square. The tablinum is generally considered as having been the place where the proprietor of the house kept his accounts and writings. Festus, on the word *tablinum*, and Pliny, in the twelfth chaper of his thirty-fifth book, give this explanation of the word. But, when we consider that it was necessary for every one who entered into the interior of the house, to pass through the tablinum, we must confess that this room could not have been very convenient for keeping writings, &c. which we do not in general wish to be exposed to every body who enters the house. It is more probable, therefore, that it was the place where the master of the house received his clients, &c. And in the more ancient times of which Pliny and Festus speak, it may have contained cases for preserving the family papers, and the like; for at that period the houses were not very spacious, and behind the tablinum there was no peristyle, nor any other of the apartments which were added in later ages. When the Romans had increased the magnitude of their houses after the example of the Greeks, the tablinum may have received another destination, though still preserving its ancient name. In the Pompeiana this apartment is described as a sort of recess or intervening passage, used in summer as a dining-room, separated from the cavædium by an *aulæum* or curtain, and in general having a window occupying the whole side.

TABULATUM, (Lat.) a term applied by the Romans not only to the floors, wainscoting, ceiling, &c. of their houses, which were constructed of wood, but also to the balconies and other projecting parts. The latter, Vitruvius designates by the name of *projectiones*.

TÆNIA, (Gr.) the fillet separating the Doric frieze from the architrave.

TAFA, *Taeeffa*, or *Teffa*, a village and district in Nubia, which contain some remarkable remains of ancient architecture. These remains are supposed to mark the sites of the ancient *Taphis* and *Contra Taphis*. The antiquities consist of several spacious oblong enclosures of masonry, between three and four feet in height, some of which are filled with blocks of stone, unfinished cornices, and parts of doorways. These enclosures are at both ends of the plain. In the centre are two buildings, one having the form of a portico, and the other, which is in ruin, appears to have been a Christian church. The former is almost blocked up in front by a mass of mud, and is surrounded with the hovels of the natives. It is a pyramidal portico facing the south. This building has been already described under the article *Nubian Architecture*. The other remain is open to the east; the north and south walls are in ruin; the west is complete. In this is a doorway, and within, in front, are two columns, with lotus capitals, supporting a small portion of roof. Scriptural paintings in distemper, as large as life, remain on the walls; and over the cornice of the doorway is the winged globe.

TAIL-IN, to fasten any thing by one of its ends into a wall.

TAIL TRIMMER, a trimmer next to the wall, into which the ends of joists are fastened to avoid flues.

TAILING, the part of a projecting brick, stone, &c. which is inserted in the wall.

TAILLOIR, a French name for the abacus.

TALMIS, an ancient city in Nubia, called now by the natives Kalabshe. Its temple is considered by Burckhardt, as ranking amongst the most precious remains of Egyptian antiquity. "In its site, it may be compared with the temples of Tentyra and Edfou, and it belongs to the best period of Egyptian architecture." The following description of this noble ruin is given by Capt. Light:—"The remains of the temple are, a butment of masonry, which rises above the bank of the river at about one hundred and seventy or one hundred and eighty feet from the front of the temple, to which, from the butment, there is a paved approach. On each side of this pavement there appears to have been a row of sphinxes, one of which lay headless near the pavement. At the end, there seems to have been steps leading to a terrace thirty-six feet in breadth, from which rise two pyramidal moles with a gateway between them, forming a front of about one hundred and ten feet. The moles are eighteen or twenty feet thick, of solid masonry: the upper part of them is in ruins. Inside this gateway is a court about forty feet in extent, now filled with broken shafts, capitals, and other fragments. It appears to have had a colonnade on the sides, joining the mole with the portico. Of this colonnade only one column remains, with a capital much disfigured, supporting a fragment of ceiling. The portico consists of four columns, engage to half their height in a wall, raised in the centre, to form an entrance. A lateral wall divides the portico from a suit of four inner apartments, separated by lateral walls, in each of which are doorways, and over them are winged globes in the cornice. Within the first apartment, there appears to have been a colonnade, of which two columns remain on the left hand, their capitals defaced, with two or three fragments of an architrave. The space within is filled with broken shafts, capitals, and blocks of an immense size. This apartment and the interior of the portico, are ornamented only round the sides of the doorways. The other three apartments are covered with the usual hieroglyphic and symbolic figures. Remains of colouring exist fresh and bright. All the apartments are encumbered with ruins, and have scarcely any ceiling left. Inside the portico are scriptural paintings, similar to those in modern Greek churches." The cella, which is fifteen paces by nine, projects several feet into the pronaos, thus forming an insulated chamber in the midst of the temple. In the adytum, Burckhardt mentions remains of columns that were lying on the ground, "the only instance of the kind," he says, "I have seen in any Egyptian temple." "In the walls," he adds, "are some low, dark recesses and windows or loop-holes, like those in the temple at Tentyra; its roof is formed of single blocks of stone, reaching the whole breadth, and upwards of three feet in thickness. There is a chamber behind the adytum, as at Dakke, and communicating with it by two doors: the roof has fallen in, but it may be seen that this chamber was lower than the adytum, and had a chamber over it. In the walls of this chamber are several cells or recesses, each of which forms two small apartments, one behind the other, divided by a narrow entrance, and just sufficiently large to hold one person." The walls of the cella and adytum are covered with painted figures. The exterior walls of the temple are covered with sculptures of colossal figures, like those of Tentyra

(Dendera) and Edfou, though not so large.

"The walls of the portico are prolonged the whole length of the building, and, by means of a transverse wall in the rear of the chamber behind the adytum, form a high enclosure all round; at about twenty feet beyond which is the general enclosure to the whole building. This is carried to the foot of the hill, which has been cut down perpendicularly, so as to serve as the end wall. In the south-west corner of the area is a small quadrangle, formed on one side, by three columns; and on the adjacent interior side, by a short wall built across the area. Here a grotto, or sepulchre, has been hewn in the perpendicular rock, similar to that behind the temple at Dandour: it consists of a single chamber, with the winged globe over the entrance, but without any other sculpture. A flight of steps leads from the propylon down to a paved terrace, which extends to the foundations of an oblong building standing just over the river, where are some fragments of columns. Visitors by water, during the inundations, might have stepped from their vessel into this building." About a quarter of an hour distant from this temple, on its north-west side, is another small temple cut out of the rock. The road to it lies through the remains of the ancient town, a heap of stones and rubbish, covering a space along the shore of about a mile and a quarter. In front of the temple is an open area, also hewn out of the rock, in which is the entrance to the cella, which is thirteen paces by six, its roof supported by two polygonal pillars. Adjoining to the cella is the adytum, a small room eight feet square, with sculptures and hieroglyphics on the walls, rudely executed. This small temple is called by the natives *Dar-el-Waly*. In the hill close by are the quarries of fine sandstone, which have furnished the stone for building the town and temples. On the rock above the village is a small Grecian temple, with fluted columns of the Ionic order. Abundance of Grecian pottery are found among the ruins of the town. The tombs of the ancient inhabitants are excavated in the adjoining rock.

Talon, a French term for the same moulding which we call the *ogee*.

Talus, a term chiefly restricted to fortification, signifying the slope of a wall which is thicker at bottom than at the top.

Tambour, (Fr. from the Arabic, *tambor*, a drum,) the naked of a Corinthian or Composite capital; the wall of a circular temple which is surrounded with columns; a place enclosed with folding doors, at the entrance of churches, &c. for the purpose of breaking the current of air from without.

Tangent, (from *tango*, Lat. to touch,) a line drawn perpendicular to the extremity of the diameter of a circle, and consequently only touching it in one point. The tangent, in trigonometry, is a line drawn perpendicularly from the extremity of the diameter, at one end of the arc, and bounded by a straight line drawn from the centre through the other. The tangent of a conic section, or algebraic curve, is a straight line drawn cutting the axis.

Tapestry, (*tapisserie*, Fr.) a kind of woven hangings, of wool or silk, ornamented with figures, and used formerly to cover and adorn the walls of rooms. This species of work is said to have been first invented by the Pergamenians. From the earliest period of antiquity, tapestry, more or less rich, has been fabricated in different parts of the east. The most grotesque compositions of men, planets, and animals, were painted or embroidered on these Oriental tapestries, and were carried into Greece at an early period. These Persian, Median, or Babylonian tapestries were known to the Greeks by the name of *barbarian tapestries*, to distinguish them from the *peplum* (πεπλον) which was exhibited at the religious ceremonies, and which represented entire fables, the complete history of a god or of a hero. These, at first coarse, were afterwards executed with more art and elegance. The Jews carried tapestries to Alexandria, and Calixenus admired those which he saw under the Ptolemies. When the taste of the Greeks and the Asiatic people became refined, these grotesque figures covered no longer, as they did in more ancient times, the whole surface of the tapestry, but were confined to the upper and lower borders. Aristotle speaks of a Sybarite, who embroidered a piece of tapestry which contained in the central part the six principal divinities of Greece; the top was bordered with arabesque of Suza, and the bottom with Persian arabesque. Tapestry of this kind was suspended in the sacred grottoes where they practised the rites of initiation. Rich Oriental tapestries were also used to adorn the interior of the temples, and to place before the entrances.

In modern times this kind of embroidery has been executed with great success; and though the works of Europeans, must be confessed to be inferior to the tapestries of the East in brilliancy of colouring, they far exceed them in design and composition.

The Anglo-Saxon wall-hangings were generally silken, and many had figures of golden birds in needlework, others woven, and some plain. Anderson asserts, that what we generally understand by the term tapestry, was invented in Flanders about 1410. In the reign of Elizabeth, men in fantastical postures, like morris-dancers, were common patterns. Arras received its name from the principal manufactory of it at Artois. The old council-house at Coventry exhibited, till 1802, a very perfect specimen of the old painted cloth hangings. The roof was of oak, ornamented with carved figures of no mean workmanship; benches with wainscoting surrounded the room to a convenient height; and the space between the wainscoting and a rich cornice of gilt vine-leaves, was covered with painted cloth. See *Painting*.

The art of working tapestry was brought into England by W. Sheldon, near the end of the reign or Henry VIII. A manufactory was established in 1619, at Mortlake in Surrey, by Sir Francis Crane, who received 2000 pounds from James I. to encourage the designs.

Tarras, see *Mortar*.

Tassels, the pieces of timber that lie under the mantel-piece in common country houses.

Tavellæ, (Lat.) bricks used by the ancients seven inches long, and three and a half broad.

Taxis, is defined by Vitruvius as that which gives every part of a building its just dimensions, according to its use. Modern architects express it by the term *ordonnance*.

Tectorium Opus, (from *tector*, a plasterer,) a name given by the Romans to a kind of plaster with which they covered the ceilings and walls in the interior of their apartments. In comparing the different passages of Vitruvius, Palladius, and Pliny, were it is mentioned, we perceive that these was the following difference between the *tectorium opus*, and that which was called *albarium*, or *album opus*. The latter was the same as that which we term stucco, the *tectorium* on the contrary was a mortar composed of a mixture of lime and sand. When marble reduced to powder was used in making the mixture, in the place of sand, it was denominated *marmoratum*. The Greeks gave both to the *tectorium* and to the *albarium* indiscriminately the names of *koniama* (κονιαμα,) and *katachrisis* (καταχρισις.) Great care was observed in the preparation of the tectorium, and Vitruvius has left us the details. They chose not only the best lime, but they also made it undergo a long course of preparation before they used it; and it was not considered fit for use until it had acquired sufficient tenacity to make it stick to the trowel like clay. According to Vitruvius, the common tectorium was composed of three layers of mortar of fine lime, and of three other layers of marble; and yet according to Winckelmann, in his treatise on the architecture of the ancients, the whole thickness of these different layers was often not more than an inch. The first process was to cover the walls and ceiling with common lime; when this layer began to dry, it was covered with a first layer of mortar of fine lime, which was smoothed and made even with the utmost care. When this layer was dry, a second, and afterwards a third layer of very fine lime. The wall was next covered with a mortar of marble, coarsely powdered, which was judged fit for use when it would no longer stick to the trowel. Before this was completely dry, another layer of marble, pounded finer, was applied, and when this was sufficiently smoothened and equalized, the last layer was applied, which was composed of marble reduced to a very fine powder. After having reduced this last to a smooth and equal face, by means of a wooden instrument, it was polished with marble. By this process, the walls and roof were covered with a stucco, which was very unique, fine, and at the same time formed an excellent ground for the paintings with which the Greeks and Romans decorated the interior of their houses; it became, moreover, in process of time, so extremely solid, that it was never liable to crack or break. This is proved by the walls of the Grecian houses, from which they could, according to Vitruvius, detach the decorated covering, without any fear of injuring it; and these paintings, after having been detached from the Grecian walls, were carried to Italy by the opulent Romans, and incrusted in the walls of their town and country mansions. At Herculaneum were found in the room of a house such squares of plaster covered with painting, which had evidently been detached from some other place, and which they had not had time to incrust in the walls of the house where they were discovered. The *tectorium* with which the walls of Pompeii and Herculaneum were covered, have been detached, and transported to the Museum of Portici. When they wished to cover with such a coating, walls which were constructed partly of timber, it might justly be feared that after a certain period of time, the plaster, where it was supported by the wood, would crack. To prevent this inconvenience, the wall was covered with clay, and on it was laid a layer of reeds, after this a second layer of argillaceous earth was applied, and another of reeds, which were laid in a direction so as to cross the other; upon these were applied the lime and marble cements. In moist places, great care was also taken, by making openings, &c. in the walls, to ensure a sufficient dryness to allow it to attain a proper solidity.

The tectorium was next covered with the most brilliant colours, such as *minium* or red, *armenium* or blue, *purpurissum* or deep purple, and a variety of others, which were applied to the last layer of plaster, while fresh laid on, and to heighten the brilliancy of the paintings, it was rubbed over with white punic wax, mixed with the purest oil. On this coloured ground were painted the arabesques, landscapes, historical subjects, of which so many remains are found among the ruins of Rome, but more particularly at Herculaneum, Pompeii, and Stabiæ.

Telamones, (from τλαω, to support,) the name given to the figures of men which are used as supporters, in the same manner as the *caryatides* or figures of women. See *Caryatides*, and *Persians*. They are sometimes called *atlantes*. See *Atlantes*. In the Museo Pio-Clementino, tom. ii. pl. 18, M. Visconti has engraved a figure of an Egyptian telamon of red granite.

Telmessus, an ancient city of Asia Minor, of which considerable ruins still remain. The theatre, the porticoes, and the sepulchral chambers, excavated in the rocks at this place, are some of the most remarkable remains of antiquity in Asia Minor. "The first and principal ruin," says Dr. Clarke, "appears from the sea, before landing, to the west of the town. It is that of an immense theatre, whose enormous portals are yet standing; it seems to be one of the grandest and most perfect specimens which the ancients have left of this kind of building. The situation selected for it, according to a custom observed throughout Greece, is the side of a mountain sloping to the sea. Thus, by the plans of Grecian architects, the vast operations of nature were rendered subservient to the works of art; for the mountains on which they built their theatres possessed naturally a theatrical form, and, towering behind them, exhibited a continuation of the immense *coilon*, which contained the seats for the spectators, giving a prodigious dignity to their appearance. Indeed, it may be said, that not only the mountains, but the sea itself, and all the prospect before the spectators assembled in these buildings, must have been considered by the architects as forming part of one magnificent design. Every thing at Telmessus is Cyclopean: a certain vastness of proportion, as in the walls of Tirynthus or of Crotona, excites a degree of admiration mingled with awe; and this may be said to characterise the vestiges of the Dorian colonies all over the coast of Asia Minor." Some of the stones used in the construction of this building are nine feet long, three feet wide, and two feet thick. Five immense portals, not unlike the uprights at Stonehenge, conducted to the arena. Three of these are still standing. The central gateway consists only of five, and the two others of three stones each, placed together without either cement or grooving. The uprights of the central portal are ten feet two inches, and five feet eleven inches high, making the whole height sixteen feet one inch; they are three feet ten inches broad and twenty inches thick. The transverse stone is ten feet seven inches long. The stones of the walls, between the portals, are eight feet ten inches long; these, too, are laid one upon another without cement, exhibiting the same simple and massive structure as the rest of the building. Before the front of the theatre extended a noble terrace, to which a magnificent flight of steps conducted from the sea. Near this theatre there are other remains, particularly a lofty and very spacious vaulted apartment, open in front, hewn in the rock beneath the declivity upon which the theatre is situated. Dr. Clarke imagines that it was an oracular cave, belonging to the soothsayers, for whom Telmessus was renowned. The most remarkable of the antiquities of Telmessus, however, are its tombs, hewn in the face of the perpendicular rock. See *Tomb.*

Tempered: this term is applied to bricks which may be cut with ease, and reduced to any required shape.

Templa, (Lat.) timbers in the roofs of Roman temples, which were placed upon the canterii, or principal rafters, and correspond in situation and use with our *purlins.* See *Roof.*

Temple, (Lat.) an edifice destined for the public exercise of religious worship. In the earliest times, people performed their worship in the open air, and erected altars of earth and stones, and frequently offered their sacrifices, in the depths of solitary woods. Hence originated the custom of consecrating woods and groves, even after they had learnt to erect temples, or at least they planted groves about their religious edifices. The earliest temples were nothing but caverns, and from this circumstance the custom of consecrating caverns was long preserved in Greece, and many by other people, but more particularly in Persia and India. (See *Hindû Architecture*, *Elephanta*, *Ellora*, &c.) The Troglodites adored their gods in grottoes. Where natural grottoes were not to be found, vast artificial caverns were formed with incredible labour. In the plains the temple was, perhaps, at first merely an enclosure, containing an altar for sacrifice. This enclosure they surrounded with upright stones, forming a rude kind of colonnade, as we find instances among the Druids of the west, and in many scattered remains of antiquity in various parts of the East. (See *Druidical Architecture*, *Pierres Levées*, *Stonehenge*, and *Persian Architecture.*)

The Druids held it unlawful to adore the gods within walls and under roofs, and their places of worship were invariably in the open air, and covered only by the canopy of the heavens. Here they formed huge temples, consisting of ranges of unhewn stone, which enclosed a circular area. They were usually surrounded with thick groves of oak; and even the majestic trees of which these groves were composed, were consecrated by druidical superstition, and associated with the attributes of divinity. The wild and gloomy spot of druidical worship was sometimes surrounded by a ditch and a vallum of earth, and was often chosen on an eminence, as such a situation allowed a free view of the heavenly bodies.

The religion of the Persians and other Oriental people, we learn from ancient writers, forbade the worship of the Deity in any other way than under the open air. The part of the Egyptian temples in which public worship was performed was unroofed, and a similar idea, perhaps, gave origin to the hypæthral temples among the Greeks.

We have in all probability a fine specimen of the open temples of the Orientals in the ruins described by Pococke and Maundrell, near *Ain-el-Hye*, (the serpent fountain :) the former writer characterises it as "one of the greatest and most extraordinary pieces of antiquity that are to be seen." A court fifty yards square, has been cut in the natural rock; the sides of the rock, about three yards high, supplying the place of walls, except on the north, where it is open. Here there are signs of two entrances, which, he thinks, were joined by a wall on each side. In the centre of this area, a square part of the rock has been left standing, three yards high, and five yards and a half square, to serve as a pedestal for a throne. The throne itself is composed of four large stones; two at the sides, one at the back, and another overhanging them, in the manner of a canopy: this is five yards and three quarters square, and has a handsome cornice sculptured round it, of a kind common in upper Egypt. The whole structure is about twenty feet high, and fronts the open side of the court. At the two inner angles of the area, there seem to have been two small apartments: pillars of the natural rock have been left here, apparently for doorways. there can be little doubt that this court was, as Maundrell supposes, an idol temple, and the pile in the centre, the idol's throne. "It seems the more probable," he remarks, "in regard that Hercules, *i. e.* the sun, the great abomination of the Phenicians, was wont to be adored in an open temple."

The early Grecian temples of which we have any account, bore a great affinity to those of the Asiatics, and other ancient people. According to Pausanias, the oracle of Delphi, in remote ages, was consulted in an arbour of laurels. Pausanias and Herodotus say, that, in the most ancient times, the oracle of Jupiter, at Dodona, delivered its oracles from an old oak. Near Magnesia on the Mæander, according to the former writer, there was a grotto consecrated to Apollo, which was celebrated as containing an exceedingly ancient statue of the divinity.

On mount Octra, in Eubœa, are the remains of a very curious temple. It has no columns, and in short is like the mouth of a cavern. The roof is simply a covering of stone, which is made to support itself, and of which no other example is known. That portion of the roof which lies upon the walls, counterpoises the weight of that which is between them, and thus forms the ceiling. The eastern wall appears to have been a little thicker, to counterbalance the slabs, which on this side were not bevelled away and notched, as were those on the west. The inclination of the slabs answered two purposes—to throw off the rain, and to throw the weight more upon the wall. The opening between the opposite projecting stones must have been about two feet, which was probably formed with a ridged stone, the whole being covered with slab stones. The remains are supposed to have belonged to a temple of the Cyllenian Mercury: (Walpole's Memoirs, 289. Fosbrooke's Foreign Topography.)

The Egyptian temples are remarkable for their massive dimensions, and for the number and disposition of the columns, contained in the several enclosures within the walls, and continue generally to the last small cella, which appears to have been but a stable, or kind of lodging for the sacred animal which it was the duty of the priests to feed. But the more simple was this small chamber, into which it is probable that no one entered but the priests; and the more magnificent the entrance and porticoes, which conducted to it, the more magic and varied were the effects of the architecture. Obelisks, colossal statues of human beings, sphynxes, and lions, were generally placed at the entrance. On each side of the entrance, two lofty masses of masonry, of a pyramidal form, arose, covered generally with hieroglyphic bas-reliefs. A corbel, scooped out in the shape of a gorge, was the only crowning ornament both of the gateway itself, and of the two lofty masses which accompanied it. No pediment or roof broke the horizontal line of the platform above, where it is probable that the priests passed their nights, according to the custom of the country. It was here that they had the opportunity of making, under a clear sky, all those astronomical observations, which were one of their principal occupations. The spectators were struck with admiration, before they entered, at the grandeur of these enormous masses, at their imposing simplicity, and at the symmetrical arrangements of the hieroglyphic figures with which they were covered. The vast magnitude of the blocks employed in their construction, the difficulty of transporting, cutting, and polishing them, all made them appear the works of more than human artisans. The scene changed on entering the first enclosure, and was varied successively by the different positions of the columns, generally of colossal magnitude, which were there distributed, sometimes in a peristyle of a single or double range, sometimes in porticoes of four ranges deep, and which presented themselves to the traveller either on his side, or before him, sometimes close by him, and at others at a sufficient distance, so as agreeably to occupy his view by the contemplation of their richness, of the brilliancy and tint of their marbles, and of the varied play of their shadows at different hours of the day. All these bodies, though at rest, seemed to move about him in the enclosure, while, at every step he advanced, their positions varied with the points of view. Different emotions occupied his mind in succession, and filled him with that trouble and inquietude by which the priests knew so well how to profit in gaining credit to their fables and oracles. It was thus, without doubt, that these men, who alone possessed knowledge in the midst of an ignorant people, made use of the powers of architecture, and the other arts, to attract by the curiosity, and to astonish by the grandeur of the spectacle, the men whose actions they wished to direct. The lateral façades were only immense walls, generally adorned with hieroglyphics; their simplicity, as well as their extent, and the curiosity excited by their mystic figures, redoubled the desire which every one felt to penetrate into the interior, to contemplate there the wonders of which he had heard mention from the initiated; to obtain this favour, he willingly submitted to perform all sacrifices, and to go through all the probations which were required of him.

The figures on plate *Temple* will give a better idea, than any description of the plan of Egyptian temples. Fig. 7, is a plan of the great temple at Dendera, (Tentyra) which has been described under the article *Dendera*. Figures 10 and 11 are temples at Thebes, near the village of Medinet Abu. Figure 10, (as well as figure 12, which is a plan of the palace at Thebes, see

Palace,) exhibits the general form of the entrance, with the two masses of masonry, the *propyla* or *pylônes*, (see *Propylon*, and *Pylône.*) Fig. 8 is a temple in the isle of Elephantina, or Philæ, and approaches more to the form of the temples of the Greeks. Fig. 9, is the excavated temple of Ybsambul, which was explored by Belzoni, (see *Ybsambul.* See also the article *Egyptian Architecture.*

In every city of Greece, and not only in its immediate environs, but also in the open country, there was a considerable number of temples. We need not wonder, therefore, that the ruins of temples at the present day occur more frequently than those of other edifices. That divinity under whose protection each city was placed, had commonly the largest and finest temple. Such at Athens was the temple of Minerva, that of Diana at Ephesus, that of Apollo at Delphi, that of Jupiter at Olympia, and those of Venus at Paphos and Cythæra, and of the Capitoline Jupiter at Rome. The temples which were built in the country were generally dedicated to the rural deities, or to those which were common to whole nations. At Panionium there was a temple of Jupiter Heliconius, built by the Ionic colonies who had come from Asia Minor to Attica. The Doric colonies of the lesser Asia had also a common sanctuary, the temple of Apollo Triopius. Near Mylassa there was a temple of Jupiter Carius, which was common to the Carians, the Lydians, and the Mysians. At these temples, the people held, at fixed periods, assemblies to sacrifice to the gods, to celebrate festivals, and to deliberate on the affairs of the whole nation. The temples of the Greeks and Romans were not generally of great extent. At first the cella was only large enough to contain the statue of the deity, and sometimes an altar. In after times, when the people were more opulent, the large sums of money which they laid out in building temples, were expended more in ornamenting them, than in making them large. Their designation did not require much extent, as none but the priests entered the cella, and the people collected around the exterior of the temple, when they wished to sacrifice to the gods. Those temples only were made large which were consecrated to the tutelary deities of a city, or to those who were principally worshipped, or those temples which were common to whole nations. They were generally made extensive, by enlarging the porticoes with which they were surrounded, and which served as a shelter in time of rain. Vitruvius gives us some information relating to the situation which the Greeks generally chose for their temples. Yet we cannot suppose that they generally observed the rules which he gives; the numerous exceptions with which we meet, appear rather to prove the contrary. Vitruvius determines the situation of temples partly according to the different divinities to which they were consecrated. The temples of Jupiter, of Juno, and of Minerva, whom several cities regarded as their protecting divinities, were built on the most elevated spot, which overlooked the whole city, or at least the greater part of it. Minerva, the tutelary divinity of Athens, had her throne in the acropolis, so that all who came to Athens could perceive her from a considerable distance; and at Rome, the temple of Jupiter in the capitol was that of the protecting god. The temples of Mercury were generally situated by the forum, or, like those of Isis reckoned by the intercolumniations, and, according to Vitruvius, they gave to each side twice the number of intercolumniations of the façade, so that a temple which had six or eight columns in front, would have on each side eleven or fifteen. Thus the temple near the Mylassa, had six columns on the façades, and eleven on each side; that of Fortuna Virilis at Rome, had four in front, and seven on each side. Sometimes, however, the columns at the sides are an even number, and either double or not double of those at the front. Thus the temple of Jupiter Panhellenius, in the island of Ægina, had six in front, and twelve on each side. The temple at Ægesta in Sicily, as well as the grand temple at Pæstum, have six columns in front, and fourteen on each side. Some temples at Selinus have six columns in front, and on the sides one of them twelve, one fourteen, and another sixteen. The greatest temple in this city had eight in front, and sixteen on each side.

Temples are classed by Vitruvius, according to the disposition of their columns, &c. into seven kinds—the *ναος εν παραστασιν*, or *in antis*, the *prostylos*, *amphiprostylos*, *peripteros*, *dipteros*, *pseudodipteros*, and *hypæthros*. The temples of Victory-without-wings at Athens, is a perfect model of the first kind: it has three columns between the antæ which terminate the walls of the cella, and the Doric entablature is continued through the whole extent of the side walls. The temple of Diana, as represented in the Iphigenia of Euripides, (Iph. in Taur. v. 113,) was of this kind. The temple of Ceres at Eleusis was *in antis*, but the addition of the portico made it prostyle, like that of Minerva Polias at Athens. The Ionic temple of the Ilyssus, and the temple of Iackly, near Mylassa, are amphiprostyle. The Roman peripteral temples, according to Vitruvius, had six columns in the fronts, and eleven in the flanks, including those at the angles: between the peristyle and the walls of the cella, was the width of one intercolumniation. The number of columns in the flanks of Grecian hexastyle peripteral temples does not appear to have been regulated by the number in the fronts: it has been believed, that it always exceeded double that of those in the front; but in the temples of Ægina, Pæstum, Argos, Syracuse, Ægesta, and Selinus, it generally exceeds the double by two or more. The dipteral temples were octastyle in the fronts, with fifteen columns in the flanks, and a double row surrounding the cella, the walls of which ranged with the columns which were third in order from the angles of the fronts. The pseudodipteral differed from the dipteral only in omitting the second range of columns which surrounded the cella. The hypæthral were decastyle in the fronts, resembled in other respects the dipteral, but had a double row of columns within the cella: the front was sometimes octastyle, and hexastyle. The temple of Pæstum, and that of Jupiter at Ægina, are hexastyle-hypæthral, as well as was the temple of Jupiter Olympius at Athens. That of Jupiter at Selinus is octastyle-hypæthral. Hypæthral temples were generally, if not universally, dedicated to Jupiter, which is explained by Varro, (De Ling. Lat. lib. iv.) "itaque inde *ejus perforatum tectum*, ut videatur divum, id est cœlum," because he had observed before, "nam olim Diovis et Diespiter dictus, hoc est aër, et dies pater." The temple of Apollo Didymæus, is mentioned by Strabo as and Serapis, in the market. Those of Apollo and Bacchus were placed besides the theatres. The temples of Hercules were generally built near the gymnasia, the amphitheatres, or the circus. Those of Mars, of Venus, and of Vulcan, were commonly without the city, near the gates. Those dedicated to Ceres were placed also without the city, in a quiet and retired place, and were visited by few, except those who were initiated in the mysteries of the goddess. The Greeks rarely placed the temple of Vesta without the walls, but generally consecrated to her the most beautiful site. Esculapius had his temple also without the walls, generally in a lofty situation, that the sick who came to consult the god might have the benefit of fresh air. The direction of the temple, according to Vitruvius, was in general so contrived, that the statue of the deity, placed in the cella, might be turned towards the west, and that those who came to sacrifice or offer up prayers, might look towards the east. When a temple stood by the side of a river, the principal façade was generally turned towards its bank. The same rule was followed in building by the public roads; the principal front always looked towards the road, so that travellers might testify their veneration for the deities, even whilst they were passing before their temples. In cities, the habitations of the people were generally built around the temple: the inhabitants of Tanagra in Bœotia were an exception to this; they erected their temples by themselves in one part of the city, and their dwellings in the other.

The entrance of the temples of the Athenians was from the east; while, on the contrary, those of the Megarians, and other people of Dorian origin, had their approach from the west, corresponding with the prevailing practice of the Romans, as found in the precept of Vitruvius. The most ordinary form given to temples was that of a long square; though sometimes they were of a circular form. Those which were of the former shape were generally twice as long as broad, and their cella had generally, on the exterior, porticos, which adorned sometimes only the front façade, sometimes both the front and back façade, and at others were carried all round the four sides. The enclosed part of the temple was called the *naos*, *domos*, *sekos*, or *cella*. (See *Cella*, *Adytum.*) The front portico was termed *frons*, *pronaos*, *prodomos*, *anticum*: the back part, when it had an entrance and portico, was termed *posticum*, and *opisthodomus*. (See these words.) Above the entablature of the columns of the two façades was the *tympanum*, or *aetos*. See *Tympanum*.

The façades of temples had always an even number of columns, either four, six, eight, or ten; and from these numbers they received the names of *tetrastyle*, *hexastyle*, *octastyle*, or *decastyle*, (see these articles.) On the two sides the columns were generally an odd number. The Grecian and Roman architects, however, were not agreed as to the disposition of the columns on the sides. When the façade had six or eight columns, the Greeks placed on each side thirteen or seventeen. Examples of this are seen in the small temple at Pæstum, in the temples of Juno Lacinia and of Concord at Agrigentum, in that of Jupiter Nemæus, between Argos and Corinth, in that of Theseus, and the Parthenon at Athens, and in several others. The Romans, on the contrary remaining without a roof or account of its magnitude, (lib. xiv.) but it is not necessarily inferred that it was of the hypæthral form. One instance of a temple not dedicated to Jupiter, having columns within the cella, was that of Minerva at Tegea. (Pausan. lib. viii. c. 45.) That the Greeks adhered to established rules for determining the proportions of the several divisions of the *ναος*, or temple within the peristyle, cannot be doubted, but it differed much from that given by Vitruvius for Roman temples.

The width of the cella in all hexastyle temples, appears to have determined the distance between the lines of the axes of the columns in the peristyles. In the following table this distance is to the width of the cella very near the ratio of 2 : 1.

Temples.	Distance between axes.			Width of cella.		
At Pæstum . . .	71	10″	0	36′	2″	5
— Ægina . . .	41	7	15	20	10	8
— Syracuse . .	66	4	54	32	1	75
Juno at Agrigentum . . .	50	0	9	25	5	0
Concord . . .	50	2	8	24	9	0
Theseus at Athens	41	5	85	20	4	5
Minerva Sunias .	40	5	6	21	0	0
Hexastyle at Selinus . . .	76	4	0	38	0	0

The Ionic temple of Minerva Polias at Athens, affords a beautiful example of the proportion between the columns, and their distances at that period. The diameter of its columns is 2′ 3″ 8, and the projection of the step before the shaft of the columns 1′ 3″ 6. The proportion of the length of the shafts to their diameter is as 8.187 to 1: the height of the capitals is 9′5, that is, only 233 of an inch more than a third of the diameter. The same proportions are found in the temples of Apollo Didymæus, Minerva Polias at Priene, and Bacchus at Teos.

The temple which has lately been discovered at Cadachio in the island of Corfu, is hexastyle-peripteral. Its intercolumniation is wide, contrary to the general rule of the Greeks in erecting temples in the Doric style, but this is not the only example remaining of a similar deviation: the portico of Philip at Delos, and the Doric temple at Gnidus, are instances in which they have even exceeded the diastyle.

It has been already observed, that the general form of temples was a long square. Sometimes, however, they were built of a circular form, though not among the Greeks at an early period. Although belonging to more modern times, they appear, nevertheless, to have been a Greek invention. There were two kinds of these temples, designated by the names of *Monopteral* and *Peripteral*. They were covered with a cupola, whose height was equal to half the diameter of the building. At Puzzuoli (Puteoli) we find the remains of a monopteral temple, built without doubt in the time of Adrian, or of the Antonines, and which is considered as a temple of Serapis. It agrees in the ensemble of its architecture with the description of Vitruvius, but it differs from it in the details. The Pantheon at Rome is another example of a circular temple.

The most ancient temples of a regular construction in Italy, appear to be those called by Vitruvius, *Tuscan temples*. In his time there was at Rome an ancient temple, constructed by Etruscan artists, and of which he has left us some account. It was the temple of Ceres, near the great circus. It dated from the year of Rome 260, having been built by the dictator,

A. Posthumius. The Tuscan or Etruscan temples were of an oblong, almost perfectly square form. The area covered by the temple was separated into two parts, that behind was occupied by the body of the temple, and the fore part by a portico of columns. The temple itself was divided into three *cellæ*. This arrangement was observed at Rome, in the disposition of the temple of Jupiter in the capitol: the central cella was consecrated to Jupiter, that on the right to Minerva, and the one on the left to Juno.

In the plate *Temple* are depicted the principal forms of Grecian temples; others are given in different plates, as in those of *Ægesta*, *Athenian Architecture*, &c. *Fig.* 1, (pl. *Temple*,) is a hypæthral temple; *fig.* 2, a dipteral temple; 3, a temple in antis; 4, prostyle; 5, a peripteral; and 6, a monopteral temple.

The admission into the cella of some temples was interdicted to all. Pausanias relates, upon report, (Arcad. c. 5, and 10,) that at the portal of the temple of Neptune, near Mantinea, the prohibition was indicated by a mere cord stretched across the doorway, and that Æpytus, son of Hippothöus, having with daring effrontery cut the cord, was immediately on entering the temple struck blind by a wave of sea water.

In different places, and at different periods, many deviations have been observed from the established rules in building temples, some of which may be supposed to have been the effects of ignorance, and others of caprice.

The temple of Minerva at Tegea is described, by Pausanias, as having an Ionic peristylium, and within an order of Doric columns, with another of the Corinthian order above them. The Earl of Aberdeen observes, that "it is possible that we ought to reverse the order in which Pausanias speaks of the exterior and interior columns; as it is more reasonable to suppose that the peristyle was Doric, and that the less massive orders were in the interior of the building. This is in some measure confirmed by the mode actually observed in the temple of Apollo near Phygalia, which is compared, by Pausanias, with that of Minerva at Tegea." It is observed, however, by the editor of the Supplementary volume of Stuart's Antiquities of Athens, that "with the example before us, (the temple of Apollo Epicurius at Phygalia) of a Corinthian column ranging under the same entablature in the midst of a series of those of the Ionic order, we have little reason to view with surprise the statement of Pausanias on the columnar arrangement of the temple of Tegea, before the principle of system had entirely pervaded the practice of the art and science of architecture." In Pl. *Carpentry*, c. 26, *fig.* 1, is the base of the Ionic columns of the interior of the temple of Apollo Epicurius, near Phygalia; and *fig.* 2, the capital. This capital has been beautifully executed by Messrs. Browne, and Co., Scagliola manufacturers, after drawings by Mr. C. R. Cockerell, at the Grange, in Hampshire, and at Oakley Park, near Ludlow, in Shropshire.

Dr. Clarke discovered, at Argos, the remains of the *hieron* of Venus. "The site is now occupied by a Greek chapel, but it contains the remains of columns whose capitals are of the most ancient Corinthian order; a style of building unknown in our country, scarcely a model of it having been seen in England, although it far exceeds, in beauty and simplicity, the gaudy and crowded foliage of the later Corinthian."

At the village of Bashita, near Batavia, in Syria, are the remains of a small temple, which is called by the natives *Kenyset-el-Awamyd*, the church of the columns. It measures ten paces long inside the walls, by eight in breadth. The eastern wall has fallen down, and the southern has been thrown out of the perpendicular by an earthquake. The northern wall, instead of completing the quadrangle, consists of two curves about twelve feet in depth, vaulted like niches, as high as the roof, which has fallen in. In the midst of the building stands a large and venerable oak, whose branches overshadow the temple, and supply the place of the roof, rendering the ruin a highly picturesque object.

In some temples there were staircases for the purpose of ascending the roof, and, in the hypæthros, to communicate with the gallery above the portico. These stairs were worked within the walls, by the side of the entrance, before the cella; and to occupy less space, they were made winding. There were staircases of this kind in the temple of Jupiter at Olympia, and remains of them are observed in the great temple at Pæstum, and in the temple of Concord at Agrigentum.

It appears to have been a principle of early Grecian architecture, which is observed most conspicuously in the temple of Minerva Polias at Athens, that antæ, when they did not support the end of an architrave, had no relation to the width of the columns of the same height. This is also observed at the sides of other prostyle temples, as that of the Ilyssus, and in the Parthenon, Theseium, Propylæa, &c. In that of Minerva Polias, these interior antæ are wrought in the blocks which fill in the wall between the semi-columns, the masonry of which has a large groove sunk, to receive the square railing-in of the back of the columns.

It has been supposed that the practice of diminishing the upper part of doors and windows was derived by the Greeks from Egypt: but the apertures in Egyptian buildings are found of equal width at top and bottom, though the ornaments around them have a very considerable expansion at the lower part.

The Parthenon is, we believe, the only early Greek temple in which the pavement of the cella, which is generally elevated above that of the pronaos, is found to be level with it. The depression of the pavement of the central part of the cella of this temple, is also considered to be conclusive proof of the original existence of an hypæthros, by its analogy with that of other temples, and with the compluvia found within the edifices of Pompeii.

The statue of the god to whom the temple was consecrated, was the most sacred object it contained, and was the grand ornament of the cella. Great care was always taken that it should be executed by a distinguished artist, though it were for a small temple. In the most early times the statue of the divinity was formed of earth and wood, afterwards of metal, stone, or ivory. There were also, in general, other statues of different divinities placed in various parts of the temple. The altar for sacrifice was placed before the statue of the divinity to whom the temple was dedicated, a little less elevated than the pedestal of the statue, and turned towards the east. Sometimes one cella contained the altars of several deities. In the Erectheum, at Athens, there was an altar dedicated to Neptune, on which they also offered sacrifices to Erectheus; there was, besides this, an altar consecrated to the hero Butes, and a third dedicated to Vulcan.

The steps which surrounded the temples may be regarded as one of their most essential parts; they served for a base, and distinguished them from other edifices. In the most ancient times, the Greeks raised their temples generally upon mountains and hills, because their most considerable cities were built in such situations. But when the cities by degrees had been enlarged, so that part of their buildings occupied the plain, the temples were raised on a kind of base, that they might be a little elevated above the common habitations of the people; and to reach the pavement from the outside, it became necessary to surround them with steps; and as these steps were found to increase the majesty of their appearance, they were afterwards adopted even in those temples which were built upon the summits of mountains.

The interior of the temples was generally decorated with paintings, representing the actions of the gods, and of the deified heroes of early ages. The whole temple was frequently surrounded by an enclosed court, called the *peribolos*, (see *Peribolus*,) and within this court was often included a grove, statues, buildings appertaining to the temple, sometimes other temples, and even buildings of a different character.

We have still many remains of different kinds of temples. We find also many representations of temples of different forms, both oblong square and circular, some raised on steps which are continued all round, and others with steps only in front. Some have four, others have six, eight, and ten columns. A medal of Venus, struck at Corinth, represents a temple *in antis*; and a medal of Trajan, minted at Galatia, represents a prostyle temple, in which the two columns between those at the angles have been left out, to give room for a figure of the statue of the god *Mensis*, whom the Galatians principally worshipped. Several medals of Corinth have different circular temples; and they are also found on some of the imperial medals: the latter represent chiefly temples of Vesta, of Mars, and of Juno Martialis: all these temples appear to have been monopteral. The ancient Greek medals have seldom representations of temples; but they are frequently found on medals of Greek cities, after they were subject to the Romans. Many of them have been executed by artists totally ignorant of the rules and principles of architecture, and often by those who were ignorant of the real form of the building which they intended to represent. On a medal of Tiberius, struck at Abdera, we have a temple with five columns in front. However, all medals do not deserve the reproach of giving false representations of edifices. The finest representations of temples are found on the medals of some Roman families, such as those of the family of Petilia and Volteja, and on the imperial medals, till about the time of Commodus. Amongst these temples figured on medals, some are dedicated to the protecting deities of cities, others belong to a nation in common, and others belong to towns which had the dignity of *neocoratæ*. The temples of the deities adored in particular cities frequently occur on their medals. Thus, on a medal of Athens, we see the Acropolis and the Parthenon. The temple of Venus Paphia is represented on the medals of the isle of Cyprus, of Sardis in Lydia, and of the city of Pergamus in Mysia. The temple of Diana adorns the medals of Ephesus, as well as those of Magnesia, on the Mæander, of Abydus, and other cities. The temple of Diana Pergæa is seen on the medals of Perga, in Pamphylia; that of Juno Pronuba, or Samia, on the medals of Samos, and that of Apollo on those of Apollonia, in Mysia; and on those of several other cities. The temple of Jupiter Capitolinus is found, not only on a medal of the family Petilia, but also on those of several of the emperors, such as those of Vespasian and Domitian, who rebuilt it. On the medals of Augustus, we have the temple of Jupiter Tonans, which he built in a most magnificent style. Temples common to a whole nation are found on the medals of Proconsular Asia, of Bithynia, Cilicia, Galatia, Ionia, Lesbus, Macedonia, Phœnicia, and Pontus. The title of *neocoros* was given, in early times, to those who had the care of the temple; afterwards it signified those who held the office of protector of the temple, who watched over its rights and privileges, guarded the sacred treasures, and had the care of the sacrifices and solemn games. The cities themselves were sometimes made the *neocori* of the temples, and often testified their pride in the office by their medals, which sometimes bear a single temple, at others two, and even three.

We here subjoin the length and width of the largest temples of antiquity raised in conformity with Grecian art. From the researches set on foot by the Dilettanti Society, the magnitude of several of them has been recently ascertained.

Temples	Lgth. in ft.	Wth. in ft.
Diana at Ephesus (Pliny) .	425	220
Jupiter Olympius at Athens (Stuart)	354	171
Juno at Samos (Antiq. of Ionia)	344	166
Apollo Didymæus at Miletus (id.)	303.6	164.5
Ceres at Eleusis (Uned. Antiq. of Attica) . . .	217	178
Great temple at Selinus (Wilkins)	367	166
Jupiter at Agrigentum (id.)	358	172

On the temples of the ancients, besides the splendid architectural works which have been published of late years, the reader may consult the treatise of Buleuyer, "De Templis Ethnicorum," in the seventh volume of the Thesaurus Antiq. Græc. of Gronovius.—Joh. Kool, De Templis Antiquorum, Lug. Bat. 1695.—Rycquius, De Capitolis.—Castalio, De Templo Pacis.—L'Abbé May, Temples Anciens et Modernes.—Stieglitz, on the Archæology of the Greek and Roman Architecture, (in German.)

Temple, Ship. Governor Pownall, in the seventh volume of the Archæologia, (p. 149.) describes a singular monument of antiquity, near Dundalk, in Ireland, which is called a ship temple. It is called by the natives, *Fas nahin aoidhche*, the one-night's work. This building is situated two miles west of Dundalk, in the barony of the same name, and is composed of a brownish grit. The two or three first courses above the ground are mostly of large stones, from two to three feet broad, and from twelve to sixteen inches high; the rest above it of stones of all sizes, from eight to twelve inches, having now and then a large stone intermixed. The mortar seems not over tenacious, as he was told the stones are easily taken away. The mount on which it stands had originally two walks round it, with as many slopes, which are almost destroyed. The country about it is very uneven, being composed of hillocks and hollows, which prevent the sight from extending to any distance. Governor Pownall thinks that it "has been the work of the Victs, or Ficts, as the Welsh call them, these Picti, Pictones, Vic-ingi, and Victones, as the Romans in different situations pronounced the name, these Vick-anders and Vick-ingers, as the word is written on their own Runic monuments," who "made *very early* incursions into, and even invasions of, Ireland." "These people came from a country, and were of a race, who paid divine honours to the form of a ship, as the symbol, idol, or rather as the temple of the divinities whom they worshipped. They supposed the gods, whom they called *Ases*, to have a ship which the *Nani* made for them, and that these gods, when they passed through the metaphysical regions of the world, sailed in this ship. To this ship they gave the name *Skidbladner*, (Edda. edit. Goransoni.) Nani fecerunt Skidbladnerum, et dederunt Frejero. Hæc adeo magna est ut par sit omnibus Asis et quidem armatis ferendis, velisque explicatis statim ventum nansiscitur secundum, quocunque sit abitura. Cum vero non navigandum sit adeo multis constat partibus ut complicata in perâ includi possit. Now, if their religious faith taught them to believe that the gods themselves chose this kind of vehicle, and that ministering gods or priests of the intellectual world prepared such for them, *what form of temple* could be more conformable to these opinions, or become a more proper symbol of the residence of these gods, *than that of a ship*." In addition, he cites Tacitus to prove that this form of temple or shrine was in use among the Suevi. He conjectures, therefore, "that this ship temple is the symbol of the sacred Skidbladner, built by the Nani." It is conjectured, by Mr. Ledwick, that these ship temples also served as tombs. "Antinöus, as appears by a passage of Epiphanius, (Cuperi Harp. p. 14.) was interred in a boat. One of the laws of the Danish prince Frotho is, that each general or officer, who fell in battle, should be burnt in a pile made of his ship. (Sax. Grammat. lib. v. p. 87.) The Icelanders buried their chiefs in a boat. Asmund would not suffer his faithful servant to lie in the same skiff with him:

'The room within the boat is too narrow
A warrior should have a better place;
For I can govern a boat by myself.'

"At length the northerns erected royal tombs, or tumuli, of the size and figure of a *great ship*, (Steph. ad Sax. Gram. p. 91.) These tombs were afterwards temples, whereat the people annually assembled to offer sacrifice for the prosperity of the nation." Another ship temple, discovered in the county of Mayo, is described in the same volume of the Archæologia, (p. 269.) "On a conical isolé hill, about two miles from the Mullet, on the western coast of the county of Mayo, stands a very ancient and curious monument, in good preservation. The walls are two feet thick, and formed of courses of well-jointed stones, but without cement. Their elevation to the roofing is seven feet; the length of the room fifteen feet; the breadth unequal, the ground-plan forming a curvilineal triangle. The door placed on one side is constituted of three large stones, two conveying uprights with an impost. The roof is made with large flag-stones, with a grassy covering. There is no tradition respecting it. The natives call it *Leabba na Fathach*, or the giant's bed." In the twenty-second chapter of the fourth book of the Gothic History of Procopius, is a description of a very ancient ship temple on the shore of the Phæacians.

Templet, a mould used by bricklayers and masons for cutting or setting the work; a short piece of timber sometimes laid under a girder.

Tenaille, (Fr.) in fortification, an outwork resembling a horn-work, but, instead of two demi-bastions, having only in front a re-entering angle between the same wings, without planks, the two sides being parallel. A *simple* or *single* tenaille, consists of two faces or sides, including a re-entering angle. A *double* or *flanked* tenaille, has two re-entering angles. A tenaille *in the fosse*, is raised before the courtin, in the midst of a fosse. A tenaille *of the place*, is the face of the place, raised between the points of two neighbouring bastions, including the courtin, two flanks raised on the courtin, and the two sides of the bastions which face one another.

Tenia, see *Tænia*.

Tenon, see *Carpentry*, and *Mortise*.

Teocalli, see *Cholula*.

Tension, (Lat.) the degree in which a piece of timber is strained by drawing it in the direction of its length.

Teos, an island of Ionia, celebrated for its temple of Bacchus, the ruins of which were visited by Chandler, and described in the first volume of the Ionian Antiquities. No vestiges of the plan, aspect, or species of the temple could be ascertained, from the confused state of the ruins. But it is described by Vitruvius as an octostyle-dipteros. The plinth of the base is formed into the upper step: if the height of the uppermost step is divided into two parts, three of them give the breadth. The diameter of the lower part of the columns is 3′ 3″ 6, which is less than the diameter of the astragal under the capital by eight-tenths, and exceeds that of the upper part of the shaft only by 1″ 8. The plinth, lower torus, and scotia, with its fillets, are of one piece of marble. The upper torus, with an astragal, is annexed to the apophyges of the column, perhaps to strengthen and protect it from injury, the projecture being very great. The small diminution of the column, Chandler thinks, proves that the two portions of the shafts he measured belonged to different columns, the upper part probably to the internal range of the dipteros, and the lower to the outer.

Tepidarium, (Lat.) the name of one of the apartments in the Roman baths. In the baths of Diocletian, before their demolition, the tepidarium appears to have been a magnificent structure; it was a grand octagonal saloon, of an oblong figure, of which each face formed a semicircle; its vaulted roof was supported by several rows of columns, of an extraordinary altitude.

Term, or *Terminus*, a sort of pillar in form of a reversed pyramid, crowned with the bust of a man or woman as a capital. See *Caryatic*.

Terra-cotta, (Lat.) baked earth. Earth or clay was the first material used by artists, both in building and modelling. In the time of Pausanias, there were in many temples statues of the deities made of this substance, as at Tritæa, in Achaia. Bas-reliefs of terra-cotta were frequently employed to adorn the friezes of temples. They served also for models to the artists. Many tombs found in the Via Appia, and in Campagna of Rome, as well as the small temple of Honour and Virtue, have ornaments of this substance. The ruins of Herculaneum and Pompeii are full of bass-reliefs and other terra-cotta ornaments, and they are to be seen in the cabinet of almost every antiquary. In modern times terra-cotta has been much used in making architectural ornaments, it being plastic, easily worked, and at the same time solid, and not expensive.

Terrace Roofs, roofs which are flat at the top.

Terras, the same as *Tarras.*

Terre Plain, in fortification, a platform or horizontal surface of the rampart, with a little slope on the outside, for the recoil of the cannon.

Tesselated Pavement, see *Pavement.*

Tessera, (Gr.) a cube or die; a composition for covering flat roofs.

Tester, (from *teste*, or *tête*, Fr. the head,) a flat canopy over a pulpit, tomb, &c.

Testudo, (Lat.) a name given among the ancients to a kind of light surbased vault, with which they covered the grand halls in the baths and mansions. They were often formed of iron, or of wood, and covered with mortar or stucco. These kinds of vaults have been discovered at Herculaneum and Pompeii, but, from their want of solidity, they have not been able to resist the catastrophe which overthrew these two cities.

Tetradoron, (Gr.) a kind of bricks, four palms in length, which were commonly used by the Greeks in building their private dwelling houses.

Tetragon, (Gr.) a figure of four sides and angles, more commonly called a quadrangle.

Tetrapastus, (Gr.) a machine with four pulleys.

Tetrastyle, (Gr.) a portico consisting of four columns.

Thatch, a roof of straw or reeds, used in cottages, barns, and such like buildings.—The antiquity of thatching is mentioned by Servius, (in Virg. Ecl. i.) and Herodotus describes the houses of Sardis as thatched with reeds.

Theatre, (Gr. from θεαομαι, to behold,) a place appropriated for the representation of dramatic spectacles. Next to the temples, among the Greeks and Romans, the theatres were the most important public edifices. The Greeks attributed their invention to Bacchus, and generally consecrated them to that god. In the earliest times, the theatre was often raised within the enclosure of his temples. Every town, which was in the least considerable, possessed a theatre, because the dramatic representations were considered not only as an amusement, but also as a part of the religious worship, and they were accordingly represented in honour of the gods. The origin of dramatic entertainments must be looked for in the solemn processions in honour of Bacchus and Ceres, at the times of harvest and vintage. At these festivals they sung the dithyrambs in honour of Bacchus, and accompanied them with dances. Afterwards appeared persons disguised as satyrs, silenuses, and nymphs, and the history of the adventures of their divinities was related, at intervals, between the dances and the choruses held in honour of Bacchus. Thespis introduced this custom into Attica, but before his time it had been practised in other parts of Greece. At Athens the first step was made towards the perfection of the dramatic art, by putting into writing those declamatory stories which had before been delivered extempore. This rude satyric drama was transformed by Phrynichus and Susarion, into the tragic and comic choruses, or into tragedy and comedy.

That they might have, in these early times, a place where they could be under shelter from the burning rays of the sun, while relating the adventures of the gods and heroes, an arbour was constructed of the branches of trees, which represented the scene. This was the contrivance they made use of in the country. But similar festivities were soon exhibited in the towns, where a wooden scaffold was raised, or more commonly the spectacles were exhibited on carts, as ancient writers report to have been the practice with Thespis. Such theatres as these at first scarcely merited the name: but afterwards particular edifices were consecrated for the purpose of dramatic representations, and were rendered remarkable by the vastness, magnificence, and beauty of their architecture.

In the Grecian colonies, it appears that theatres, well distributed, were built at an earlier period than even in Greece itself. At Ægesta, in Sicily, and in the isle of Cysthena, (now *Castella Rosso,*) at the southern point of Asia Minor, are found theatres that appear to be of very high antiquity: their disposition is very simple, and they have but a single stage of seats, to which two stairs, disposed in a manner altogether arbitrary, and destitute of symmetry, conduct, which probably was regulated by the conveniences of the place. At Adria, a colony of the Etruscans, are also found the remains of a theatre, which cannot have been a work of the Romans, but which must be dated from a more remote antiquity, as is evident from its architecture, and from the history of this city. These theatres, with many others in the Grecian colonies, were constructed of stone, at a period when, in Greece itself, almost the sole material used in the erection of such buildings was wood. In the time of the dramatic poet Pratinas, who lived in the seventieth olympiad, there existed, even at Athens, only a wooden theatre. During the representation of one of his pieces, the seats gave way, and this accident was the cause that, in the time of Themistocles, a theatre of stone was erected, which was named the *theatre of Bacchus*, because it was situated near an ancient temple of that god. It was hollowed out of that flank of the mountain of the Acropolis which looks towards mount Hymettus, and was of a considerable extent, as was required in a city so populous as Athens. Athens appears to have been the first city of Greece proper which possessed a theatre of stone. At Lacedæmon there was a theatre of white marble, and the ruins of it still bear witness to its extent and beauty. A view of them may be seen in the first volume of Le Roy, Monumens de la Grèce, pl. 27. The chief of all the theatres of Greece were those of the isle of Ægina, of Epidaurus, and of Megalopolis. The theatre of Epidaurus, situated in the sacred grove of Esculapius, was built by Polycletus, and surpassed, in the perfection of its disposition, and in the beautiful proportion of all its parts, every thing of the kind in Greece. Some ruins of this theatre still remain, and are described by Chandler, and also by Villoison in his *prolegomena* to his edition of Homer, page l. note (1.) Those of Ægina and Megalopolis were equally celebrated.

About the time when this theatre

was built at Athens, it appears that the people of Magna Græcia, of Sicily, and of Asia Minor, were either building new theatres, or embellishing the old ones in most of their cities. Sicily had many fine theatres; and, according to Cicero and Diodorus Siculus, those of Agyrium and Syracuse were more particularly celebrated. The latter was remarkable for its size, as well as for its fine situation, and its ruins are at the present day an object of admiration to travellers. At Tauromenium there was also a magnificent theatre, which, if we may form our judgment from the plan, is of Grecian origin; but it appears to have been rebuilt and embellished by the Romans, from the disposition of the scene, and the portico behind the highest range of seats. For an account of these theatres, the reader may consult Riedesel, Voyage dans la Sicile, &c. and M. Houel, Voyage Pittoresque.

Modern travellers find remains of theatres in several cities of Asia Minor. The greater part are not of so remote a date as the times of the Greeks, but they have been built, or at least rebuilt, by the Romans, and distributed according to their manner. Chandler and Pococke are the two travellers who give us the largest details of the remains of the Asiatic theatres, which are found at Ephesus, Alabanda, Teos, Smyrna, Hierapolis, Cyzicus, Alinda, Magnesia, Laodicea, Mylassa, Sardis, Miletus, Stratonicea, Telmessus, Jassus, and Patara.

In all their possessions, and in the cities newly conquered, the Romans erected theatres, or at least embellished those they found there. They gave to the city of Catana, in Sicily, a theatre most magnificently adorned, as is proved by the numerous fragments of columns, entablatures, mouldings, and other ornaments, of the finest marble, and worked with infinite taste, art, and precision. At Oranges and Arles, and among the ruins of ancient Saguntum in Spain, there are found remains of Roman theatres, as well as in different ancient cities in Italy, as Pompeii, Herculaneum, Eugubium in Umbria, Antium, Pola, &c.

It was not till the year 391, after the foundation of Rome, that the first theatrical pieces were exhibited at Rome, on account of a pestilence which the people hoped to arrest, by games and rejoicings in honour of the gods. Before this epoch, the Romans had only been acquainted with the games of the circus. For a long period, the theatres at Rome were made only of wood: when the representations were ended, these edifices were demolished; they only consisted of a scene, without seats for the spectators, who were obliged to stand all the time. Marcus Æmilius Lepidus was the first who erected a theatre with seats. When, at a later period, the censors Messala and Cassius wished to build a similar edifice, they were warmly opposed by Publius Cornelius Nasica, who feared that this innovation would corrupt the manners of the Romans; and the building was interdicted by the senate. Pompey was the first who built at Rome a theatre of stone, intended to last longer than the first representations. He embellished it with the greatest magnificence, and enriched it with the principal Grecian statues which were then at Rome. Tiberius caused the scene of this theatre to be repaired, but it was not finished till the time of his successor, Caligula. It was also repaired by Claudius, and this theatre was preserved for a long time, having been rebuilt by the Gothic king Theodoric, when it had fallen into ruins. Besides this theatre, there were at Rome two others, which were distinguished by their greatness, that of Balbus, and that of Marcellus. The first was built in honour of Augustus, by Cornelius Balbus; the other was built by order of the emperor himself, who gave to it the name of his friend Marcellus. A palace has been, in more modern times, built on its ruins; but a part of the exterior wall of the theatre may still be seen, consisting of two ranges of arcades placed one above the other.

The principal authors who throw any light on the interior disposition of the ancient theatres, are Julius Pollux, and Vitruvius, whose descriptions are unfortunately far from clear. The latter, too, makes no distinction between Greek and Roman theatres, which often leads his readers into errors.

In the position of their theatres, the Greeks always seized a locality where nature favoured the requisite arrangement of the theatre, and constructed their edifices on the side of a hill, by which they incurred a much less expense in the erection of these magnificent structures. When the immediate nature of the hill allowed, as at Chæronea, Argos, and many other places, they cut very many of the seats out of the solid rock, or laid the stone seats immediately upon the soil, and often sunk the orchestra and some of the lower rows of seats below the general surface.

The only instances now known of Greek theatres built in a plain, are those of Mantinea and Megalopolis, in European Greece, and a small one near Arabi-Hissar, probably the ancient Alabanda, in Asia Minor. When, however, the situation chosen for a theatre was a plain, with no elevations, it became necessary to erect a building to support the seats; but this appears to have been very rarely the case, at least we know only two examples, the theatre of Marcellus, and that of Gabala in Syria, figured in the 29th plate of the second volume of Pococke's Description of the East. The Grecian theatres were often of very great dimensions.

The Dionysiac theatre at Athens, as appears from a passage in Plato, was capable of containing more than 30,000 persons. It must, therefore, have been much more spacious than it can be traced in the ruins. The diameter of the theatre of Epidaurus is 366 feet; those at Argos and Sparta, and that near Dramatzûs in Epirus, were about 500 feet in diameter.

Vitruvius thus describes the mathematical delineation of the parts of the theatre. "Describe within a circle three squares whose angles touch the circumference; that side of the square nearest the scene, and which cuts off a segment of the circle, defines the limits of the proscenium, and another line drawn parallel to the last, and forming a tangent to the circle, determines the front of the scene. Through the centre of the orchestra, opposite the proscenium, a parallel line is drawn, and where it cuts the circumference, the points form two centres, and the compass being placed upon that to the right, a circle is described by the left interval towards the right-hand side of the proscenium. In like manner with the centre on the left, by the right interval, a circle is described on the left-hand sides. Thus, by this delineation from three centres the Greeks have the orchestra more ample, the scene more receding, and the pulpitum, which they call λογειον, narrower. Therefore, with them, the tragic and comic actors appear on the stage, but the other performers in the orchestra. Hence the Greek distinctive terms *scenici*, and *thymelici*. The logeion should not have less than ten, nor more than twelve feet in height. The flights of steps between the cunei and seats are opposite the angles of the squares up to the first præcinctio; from that præcinctio, the next flights are in the intermediate spaces, and up to the summit vary in the same manner, should there be other præcinctiones." (Vitruv. lib. v. c. 8.) "The theatre of Patara," Col. Leake (Tour in Asia Minor) observes, "is an exception to this rule for constructing the curve of the orchestra or cavea, this curve being in all these theatres (those which he has before mentioned) a segment of one and the same circle, instead of being formed from three centres."

The ancient theatres consisted of three principal parts, the κοιλον, which was called by the Romans *cavea*, the ορχηστρα, and the σκηνη. The *cavea* of the Romans was divided into three parts, which were distinguished by the three terms *ima*, *media*, *summa*: *ima* was the orchestra, *media* the ranges of seats occupied by the knights and better orders of people, *summa* the uppermost rows appropriated to the lower orders, and the women. The koilon (κοιλον) was composed of a succession of seats, divided into two or three flights by διαζωματα, or præcinctiones. The number of seats in each flight varied according to the size of the theatre, and they were again subdivided into κερκιδες, or wedge-shaped masses, by perpendicular radiating stairs, called κλιμακες. In some instances, as in the theatre at Laodicea, there were other shorter stairs between each of these, in the upper rows of seats. Above the upper flight was a covered portico (*tectum porticus*,) which protected the audience from the currents of air, and confined the voices of the actors within the koilon. In this portico were the entrances. The *orchestra* lay between the logeum, or proscenium, and the koilon, and was appropriated to the dance of the chorus; in the centre was the thymele, where was the altar on which sacrifices were offered to Dionysus, and where were placed the tripods, crowns, and other prizes. The *scene* was the part of the stage more particularly devoted to the principal performers, deriving its name from the custom of exhibiting the first dramatic performances under the shade of trees, (σκηνη, umbraculum, quòd olim sub arborum umbraculis prima dramata fuerint acta, Schol. in Horat.) It was divided into two parts: the *hyposcene*, ὑποσκηνιον, was the stage on which the principal performers, or *scenici*, only recited; the *scene* itself was the wall exhibiting the dramatic decorations; the parascenia, παρασκηνια, was the enclosure, behind and on each side of the scene, appropriated to the convenience of the actors when they retired from the stage. In this division were disposed the various machines which were used in the representation, such as the phryctorium, φρυκτωριον, or beacon; the διστεγια, or house with two stories; the θεολογειον, or sky platform for the gods; the γερανος, or crane; the βροντειον, or artificial thunder machine; the κεραυνοσκοπειον, or lightning machine; the μηχανη, a machine on which the deities ascended; the καταβληματα, or embroidered pictures; the κλισιαδες; the αναπιεσματα, &c. See, for farther information, the articles *Scene*, *Orchestra*, *Proscenium*, *Echea*, *Thymele*, *Podium*, *Parascenium*, and the other terms mentioned in this article.

The openings or entrances which lead to the orchestra, and to the seats of the spectators, were differently situated, accordingly as the seats were placed on the declivity of a mountain, or on a particular edifice constructed to support them. When the theatres had the former disposition, the seats of the spectators descended as far as the orchestra, as in the theatres at Ægesta, in the isle of Cysthenes, at Telmessus, &c., and the stairs also were prolonged to the orchestra, and from thence the people ascended to the higher seats. The orchestra was approached by two great lateral entrances. When the orchestra was separated from the stairs, roads were made on the side of the mountain, which led to the highest range of seats, whence people might descend by the stairs to the others. Such was the case with the theatre of Tyndaris, and that of Tauromenium. The theatre at Syracuse had particular entrances for each of the three stages, and each stage was destined for one quarter of the city. In the theatres situated on a plain, the entrances were formed in the building which supported the seats; and each stage had a separate entrance, to facilitate the departure of the spectators; when the spectacle was terminated.

From an inscription found at the eastern entrance of the theatre at Patara, in Lycia, of which the following is a translation, it appears that the logeum, which is generally considered to have been built of wood, was often of more durable materials.

"To Antoninus Pius, consul the fourth time, father of his country; to the Dii Augusti; and to the Dii Penates; and to her beloved country, the city of Patara, the mother city of the Lycian nations; Velia Procula, of Patara, the daughter of Quintus Velius Titianus, has dedicated and consecrated both the proscenium (προσκηνιών) which her father, Quintus Velius Titianus, raised from the foundation; and the ornaments upon it, and the things belonging to it, and the erection of the statues of men and of gods, and the building of the logeum (λογειων), and the incrustation of it (with marble), which things were done by herself; but the eleventh step of the second præcinctio (διαζωμα), and the curtains (τα βηλα) of the theatre, raised both by her father and herself, had been already dedicated and delivered over, according to the decree of the most august senate." (Walpole's Memoirs, vol. i. and ii. See the Ionian Antiquities, vol. ii., Beaufort's Caramania, and Leake's Asia Minor.) The Vela (βηλα) here translated curtains, are supposed to signify the velarium, or awning, sometimes extended above the cavea, to protect the audience from the effects of the sun.

On Pl. *Athenian Architecture*, A 14, is given a plan of what Stuart calls the theatre of Bacchus, at Athens, but which has since been proved to be the theatre of Herodes Atticus, the site of the former having been discovered in another place. The building is in so ruinous a state that it was with difficulty he could give a tolerable description of it. As this theatre was an odeon, the system of Vitruvius cannot be expected altogether to agree with it. On the plan, "we must observe," says Stuart, "that the exterior wall is the portion of a circle, the centre of which being found, it will follow, from the precepts of Vitruvius, if we suppose what he has said concerning the Greek theatres applicable to this building, that the extent of the proscenium, with the situation and dimension of the orchestra, may be determined. For the distance *a b* from the centre *a* of the exterior circle, to the front of the scene D *b* B will be the radius of a lesser concentric circle, in which three squares being inscribed, after the manner he has directed, the side of the square *g f* nearest to the scene, and parallel to it, will then mark the limit of the proscenium, and the remaining part of the circle, if we do not mistake Vitruvius, will form the space assigned by him to the orchestra; within which space, I am persuaded, the pulpitum or logeum projected at least as far as to the centre *a*, for I cannot imagine that the actors were confined to the narrow space assigned by this scheme to the proscenium, or, in other words, that the pulpitum and proscenium were, as Galiani has imagined, only different names for the same place. Pollux, whose evidence will have great weight in this disquisition, enumerating the parts of a theatre, specifies the orchestra, the logeum, the proscenium, the parascenia, &c. as different and distinct places; besides, if they were not, and the logeum was only a part of the proscenium, it would follow, that many of the spectators would be in a situation where they could see but very little of the actors, and others would not see them at all, during the whole representation; a defect which it is not easy to conceive could exist in a building where great art and expense were employed, principally with intention to accommodate the audience in such manner that they might all see and hear to the best advantage whatever was produced on the stage."

In the plan D *b* B is the front of the scene; *b* the royal folding door (mediæ valvæ aulæ Regiæ. Vitruv.:) *c* one of the hospitalia doors; BC the versura, or return of the wall; EFG the orchestra; *d e* the katatime, præcision, or section, dividing the extremity of the pulpitum next the orchestra; HH the parascenia, (others suppose that the parascenia were divisions of the theatre behind the scene); KLM the external, encompassing the seats of the spectators; LN the portico, containing the seats for the women; NO the upper range of seats; OP the præcinctio, or circular corridor, separating the upper from the lower ranges of seats; PF the lower ranges of seats; R an aperture leading from the staircase to the corridor OP. The seats for the spectators were here cut in the rock, and consequently had no staircases under them, to conduct the spectators to the upper range of seats, as in the theatre of Marcellus, and the amphitheatres of Rome and Verona: no vomitoria were therefore necessary; but there were ample staircases at each extremity of the front, which are marked QQ. S marks the apartments behind the scene, where Vitruvius says the chorus was prepared; T appears to mark the Portus Eumenici. The plan of this theatre is remarkable for the small depth of its proscenium; the recesses which remain in the wall indicate the number and width of the cunei, which were seven. The three ranges of arches above each other display a Roman style of architecture; the arches of the middle or second range have a descending soffit towards the interior, which proves part of the edifice to have been covered, which corresponds with the statement of Philostratus concerning the Odeum of Herodes. (Philostrat. in Herod.) Within the proscenium there is a well of brackish water, supplied probably from the spring of the Asclepieum. Water seems to have been a frequent accessary to the ancient theatres. In that of Syracuse there is an ancient conduit for water encircling the koilon, cut in the rock beneath the seats. At the theatre of Nicopolis, in Epirus, there are three openings in the cavea, which Mr. Hughes supposes to have answered a similar purpose. The Roman theatres were not only refreshed by water, but even sometimes perfumed with odoriferous showers. See D'Orville's Sicula. p. 264. Hughes' Travels, vol. i. pp. 100, 420.

The site of the theatre of Bacchus or Dionysus, is now incontestably identified with that which Stuart supposed to be the Odeum of Pericles. Of this vast building how few marks can be traced! Above it, on the rock of the Acropolis, is a cavern, and the Choragic monument of Thrasyllus, (see *Athenian Architecture*,) and near it was the street of Tripods. A representation of the Dionysiac theatre is given on an Athenian bronze medal, now in the British Museum, an engraving of which is given by Mr. Leake, which exhibits its position below the cavern in the rock. See Chandler's Travels, vol. iii.; Stuart's Athens, the last edition, chap. iv., with the notes of his last edition.

The reverse of a medal, struck under Gordianus Pius, at Heraclea in Bythinia, and published by Buanarotti, among the medallions of the cabinet Carpagna, represents a theatre, with a portico behind the scene, and a temple attached to it.

In pl. *Castle*, c. 65, *fig*. 9, is a plan of the theatre of Marcellus at Rome. Its form was that of a regular semicircle. Around the semi-circular orchestra *a* were raised in concentric circumferences, the walls and galleries *f f* communicating by the stairs *g g*. The proscenium *b*, occupies the space between the galleries *d d*. These communicated with the porticos of the scene, the middle of which was generally occupied by the pulpitum; *e*, *e*, is a vestibule, which has its entrance near the stairs which conduct to the other parts of the edifice.

The Olympic theatre at Vicenza, which was built by Palladio, in 1583, was designed in imitation of the ancient theatres: its form is a semi-ellipse, encompassed all round with a frame-work of stairs, consisting of fourteen steps of wood for the spectators. The greater diameter of the ellipse is ninety-seven feet and a half, and its lesser, as far as the stage, is about fifty-seven feet and a half. At the summit of this staircase, or receding galleries of stairs, is a corridor of the Corinthian order, which, from the narrowness of the ground, could not be detached from the outer wall all round; the nine central, and the three external intercolumniations, therefore, when the columns touched the external wall, Palladio filled with niches and statues. The stage is constructed with two tiers of columns of the Corinthian order, and surmounted with a light and well-proportioned attic. On the stylobate of the second story are placed statues, and the intercolumniations are also enriched with niches and statues. The panels of the attic are ornamented with reliefs representing the labours of Hercules. The central panel, over the largest of three openings in the proscenium, is arched, and exhibits a representation of an ancient hippodrome. The following inscription, recording the period of its erection, is placed over the arch:—

VIRTUTI AC GENIO
OLYMPICORVM ACADEMIA THEATRVM HOC
A FVNDAMENTIS EREXIT
ANNO M. D. LXXXIIII. PALLADIO ARCHIT.

In the front of the stage are three openings, through which are seen three majestic avenues, with magnificent palaces and private dwellings on each side of them, finishing with triumphal arches, planned and executed in alto-relievo, foreshortening and diminishing perspectively, by Vincenso Scamozzi. A full account of this building is given in L'Origine dell' Academia Olympica, &c. opera di Ottavio Bertotti Scamozzi, 1690.

The famous theatre of Parma, which has often been attributed to Palladio, was the work of Gio. Battista Magnani, and Leonella Spada, who performed the paintings, &c. It is of a semicircular form with two straight sides added; it is in length, from the front of the stage to the wall, about a hundred and twenty-five feet, and its breadth, reckoning from the wall behind the boxes, about ninety-three feet. Around the pit, which is about forty-eight feet broad, there is a gradation of fourteen rows of seats, with two entrances at the sides, and a large ducal balcony in the middle. Each entrance has a large winding staircase. Over these seats are two stately boxes, one Doric, the other Ionic, each having a gradation of four rows of seats. The upper decoration of the boxes is sustained by enchased pillars, between which are arches sustained by other pillars, the whole causing a great confusion in the appearance, and forming an impediment to the view of the spectators who are in the boxes. The two great lateral entrances are between the seats and the stage, and in the middle of the upper arch, on a very high pedestal, is an equestrian statue. The effect of the stage and the orchestra is hurt by great projections and unmeaning arches, and the front of the stage is extremely narrow and inconvenient. This theatre is now in a very ruinous state.

The theatre of Milan begins from its foundation with a curve of a diameter of seventy-two feet, which gradually widens into two straight sides. The length of its pit is one hundred and forty feet, which is almost double its breadth. This theatre, in its form, is directly opposite to most other modern theatres, which all run narrow towards the stage; whilst this widens. The theatre of Fano, which was built by James Torelli, is of a form somewhat resembling that of a dressing-glass, being eighty-four feet long, and in breadth a little more than one half of its length. It has a convenient double staircase, leading to the fifth tier of boxes. On each side of the stage are two columns, and in the niche between them are statues, and in the centre the inscription, THEATRUM FORTUNÆ. The theatre at Verona, which was built by Francesco Galli Bibiena, is in figure a curve, which gradually enlarges in proportion as it approaches the stage, and the boxes project out more and more as they are distant from the stage. The orchestra is divided from the audience. Between the auditory and the stage are doors leading to the pit, according to the custom of the ancients. Besides the exterior roof, there is an internal one of boards, with holes in certain places, which, like the body of a musical instrument, renders the theatre very sonorous.

The theatres of Modern Rome are the worst in Italy, being all irregular, ill-shaped, and inconvenient. The largest is that of the Aliberti, which is the work of Ferdinand Bibiena, and forms an irregular and incommodious curve, with six rows of arched boxes. The pit is about fifty-five feet in length, by fifty-one feet and a half in its greatest breadth. It has miserable entrances and staircases. The theatre of Tordinona, which was built in the seventeenth century by Carlo Fontana, and rebuilt under Clement XII., is of a figure nearer to a circle than any other. Its greatest diameter is fifty-two feet, and its smallest forty-eight. The Argentine theatre, built by the Marquis Girolamo Teodoli, is the most modern theatre in Rome, and has six tiers of boxes. It is of an irregular figure, resembling a horse-shoe. Its greater diameter is fifty-one feet, and its lesser forty-six.

The royal theatre Turin, erected by Count Benedetto Alfieri, principal architect to the king of Sardinia, in 1740, is of an oval figure, and the pit is fifty-seven feet in length by fifty in breadth. It is annexed to the royal palace. It has six tiers of boxes, in the second of which is the royal box, which includes five boxes, ornamented with balustrades, and covered with a superb canopy over the centre: it projects out in a circular form, and under it is the principal entrance into the pit. The last tier, which they call the dovecote (*piccionara*), has a balustraded parapet, with a circular row of seats in front, for servants out of livery; the left side is for the public, and the right for the servants of the court, and those of the ambassadors. There is, under the orchestra, a cavity, with two tubes at the ends, which extend to the height of the stage, intended to improve the sound. The ceiling is arched, and the convex part covered with strong cemented bitumen, to prevent the water from penetrating through, and thus damaging the paintings underneath. Within the cornice also, boxes are continued round, well caulked and covered with bitumen, and filled with fine sand, for the purpose of absorbing any small quantity of water that may chance to get in. The proscenium is decorated with two Corinthian columns on plain pedestals, and between the columns are boxes for the actors. The entrances, stairs, galleries, lobbies, corridors, &c. are extremely magnificent. The theatrical part is extremely well furnished with every necessary machine or other convenience. The theatre royal at Naples resembles in form the Argentine theatre at Rome, that is, it is of the shape of a horse-shoe, or a semicircle whose extremities elongate in almost straight lines, but draw nearer to each other as they approach towards the stage. The greatest diameter of the pit is about seventy-three feet, and the smallest sixty-seven. The building is all of stone; the stairs are magnificent; the avenues, vestibules, corridors, and lobbies are all very spacious.

The theatre of Bologna, which was finished in 1763, by Antonio Galli Bibiena, is of the shape of a bell cut lengthways, its length in the pit being sixty-two feet, and its breadth at the stage about fifty. The imposts and pilasters which divide the boxes are overloaded with cartouches, scrolls, brackets, and other wretched ornaments of the Roman school of architecture. The exterior principal front is ornamented with two orders well divided; the first of insulated Doric columns, with arches over the capitals in a most barbarous style, the other of a mixed Ionic, with windows between. The theatre at Montpellier has internally the shape of a bell, is about forty-four feet long, and thirty feet broad. In the palace of Versailles, M. Gabriel, the king's architect, erected in 1770 a theatre after the manner of the ancients, of a semicircular figure, with seats all round, encompassed with a gallery. At Petersburg, under the empress Elizabeth, a magnificent theatre was erected within the imperial palace, by Count Rastelli, a Venetian. The stage is about seventy-two feet long, and the rest of the theatre, which is of an elliptical form, is a hundred and three feet long. There are five tiers of boxes, the first having a balustrade, the second tier an arched front to each box, the third drapery, *a la toilette*, the fourth plain with flat sides, and the fifth open, without any divisions. The imperial gallery is in front, and was adorned by M. Le Motte, a French architect, with four columns. The court goes into this gallery, to see the dances; but to hear the opera better, they go into a box near the orchestra. The stage has two columns on each side.

With relation to modern theatres, Mr. Wyatt, the architect of the present Drury-lane theatre, in his report, arranges the necessary characteristics of the design of a theatre, under four different heads,—"first, the size, or capacity of the theatre, as governed by the width of the proscenium, or stage-opening, and by the pecuniary return to be made to those whose property may be embarked in the concern. Secondly, the form or shape of the theatre, as connected with the primary objects of distinct sound and vision. Thirdly, the facility of ingress and egress, as materially affecting the convenience of those going to every part of the house respectively; as well as their lives, in cases of sudden accident and alarm. Fourthly, decorum among the several orders and classes of the visitants to the theatre, as essential to the accommodation of the more respectable part of those visitants, and consequently of great importance to the interest of the theatre." These are more fully discussed in the report itself. In large theatres, he recommends thirty-five feet for the width of the stage opening. The following will give a comparative view of the dimensions of the stage openings in some of the principal theatres in Europe:—

	feet.
Parma	40
Turin	39
Bourdeaux	39
Argentine, at Rome	36
Milan	40
San Benedetto, Venice	40
Theatre François, Paris	40
Theatre Italien, Paris	33
Covent Garden	37
Former theatre at Drury Lane	46
Afterwards reduced to	33

With regard to the size, as regulated by the pecuniary return, amongst other observations, he gives the following statements:—"A theatre, consisting of three-fourths of a circle, with a proscenium according to my plan, which shall limit the stage opening to thirty-five feet, will contain, in four different heights, seventy-eight boxes, holding 1004 persons; with four boxes, of larger size than the rest, next to the stage, on each side of the theatre, capable of containing 188 spectators in addition to the 1004 before mentioned,

Amounting, in the aggregate, to 1192 persons, or	£417	4	0
A pit, containing 911 persons, or	159	8	6
A two-shilling gallery for 482 persons, or	48	4	0
A one-shilling gallery for 284 persons, or	14	4	0
Total	£639	0	6

exclusive of four private boxes in the proscenium, and fourteen in the basement of the theatre, immediately under the dress boxes. Suppose the four private boxes in the proscenium to be appropriated to the managers, and certain other persons connected with the theatre, who shall pay no rent for those boxes, the remaining fourteen private boxes will let as follows: namely, the twelve smaller ones for £300 each, and the two larger ones for £500 each, for the season, (being at the rate of £23 per night, for 200 nights,) which, together with the foregoing amount, produces an aggregate total of £662. 6s. 6d."

On the subject of theatres, the following are the principal works that have been published:—On ancient theatres—Boindin, Discours sur la Forme et la Construction du Théâtre des Anciens, in the second vol. of the Mémoires de l'Académe; Ant. Bocchi, Osservazioni Sopra un Teatro antico scoperto in Adria, Venez., 1739, 4to.; Girol. del Pozzo, Sopra i Teatri degli antichi. On theatres in general—Trattato de Teatri, Ver., 1728, 4to.; J. Capi, opera del Teatro, Ven., 1789; Nic. Sabattini, Pratica di fabricar Scene e Machine, &c., 4to., Rom., 1638; Motta, Trattato Sopra la Struttura de Teatri, fol., 1676; Arnaldi, Idea d'un Teatro, 4to., Vic., 1762; Projet d'une Sallo de Spectacle pour un Théâtre, 8vo., Par., 1766; Vues sur la Construction Intérieure d'un Théâtre d'Opéra, 2 vols., Par., 1766; Exposition des Principles, &c., des Théâtres Modernes, 12mo. Par., 1769; Dumont, Suite des Projets, &c., folio, Paris, 1773; Roubo, Traité de la Construction des Théâtres, &c., fol., Par., 1776; Noverre, Observations sur la Construction d'un nouvelli Salle d'Opéra, 8vo., Par., 1781; Patte, Essai sur l'Architecture Théâtrale, 8vo., Par., 1782; Lamberti, La Regolata Construzione de Teatri, fol., Naples, 1787; Ricati, Della Construzione de Teatri, 4to., Bas., 1790; G. Saunders, Treatise on Theatres, 4to. Lond., 1790; Montenari, Dicorso del Teatro Olimpico, 8vo., Pad., 1733, 1749, 1752; Patte, Description du Théâtre de la ville de Vicenza, 4to., Par., 1779; Planta e Spaccato del Teatro di Bologna, fol., 1763; Dumont, Plans des belles Salles des Spectacles, Paris, 1760; Louis, Description de la Salle de Spectacle de Bourdeaux, fol., Par., 1792; Wyatt, A Description of the Theatre Royal, Drury Lane, 4to., Lond.

THEBES, a very ancient city of Egypt, formerly renowned for its power and wealth, and now celebrated for the amazing extent and magnificence of its ruins. The space covered by the ruins is now occupied by nine distinct townships. "Very imperfect ideas," Mr. Belzoni remarks, "can be formed of the extensive ruins of Thebes, from the accounts even of the most skilful and accurate travellers. The most sublime conceptions that can be derived from the most magnificent specimens of our present architecture, would fall very far short of these ruins; for such is the difference, not only in magnitude, but in form, porportion, and construction, that even the pencil can convey but a faint idea of the whole. It appeared to me like entering a city of giants, who, after a long conflict, had been all destroyed, leaving the ruins of their various temples as the only proofs of their existence. The temple at Luxor presents to the traveller at once one of the most splendid groups of Egyptian grandeur. The extensive propylon, with the two obelisks and colossal statues in front—the thick groups of enormous columns; the variety of apartments, and the sanctuary it contains; the beautiful ornaments which adorn every part of the walls and columns; the battles on the propylon—cause, in the astonished traveller, an oblivion of all that he has seen before. If his attention be attracted to the north side of Thebes, by the towering remains that project a great height above the wood of palm-trees, he will gradually enter that forest-like assemblage of ruins of temples, columns, obelisks, colossi, sphinxes, portals, and an endless number of other astonishing objects, that will convince him at once of the impossibility of a description. On the west side of the Nile, still the traveller finds himself among wonders. The temples of Gournou, Memnonium, and Medinet Abou, attest the extent of the great city on this side. The unrivalled colossal figures in the plain of Thebes, the number of tombs excavated in the rocks, those in the great valley of the kings, with their paintings, sculptures, mummies, sarcophagi, figures, &c. are all objects worthy of the admiration of the traveller."

Dr. Richardson begins his description at the village of Gournou. The temple here is small, when compared with the Memnonium, and that of Medinet Abou, but is much larger than those of Deir, &c. It is in a very dilapidated state. The principal entry appears to have been from the south, where there is a row of eight columns, which run along the front of the wall. A passage leads into a chamber; from each side of which, passages branch off into other chambers or courts.

Proceeding west from the temple of Gournou, at a distance of about three-quarters of a mile, we come to a broad avenue that has been formed for nearly an equal distance from the side of the precipitous rock. This beautiful avenue is exactly opposite to the grand propylon of the great temple at Carnac, and has been lined with a row of sphinxes of quartzy sandstone, highly crystallized. Fragments of gigantic statues are found scattered about. This avenue was terminated by a temple, part of the walls, and some of the chambers, of which still remain, but so much obstructed with rubbish as to preclude the possibility of examining it. Attached to it, on the south side, there is a large stone vault, in the form of an arch, without being constructed on that principle: the stones on the outside of the wall are built in line; but each successive course projects further into the interior of the building than the one below it, and the corners of the stones are rounded away, so as to give it the vaulted form.

The term Memnonium is used, by Strabo, to designate that part of ancient Thebes which lies on the west side of the river. The French *savans* have restricted it to the magnificent ruin which we are proceeding to describe. This beautiful relic of antiquity looks to the east, and is fronted with a stupendous propylon, of which 234 feet in length are still remaining. The propylon stands on the edge of the arable soil; but the area for the dromos behind it is floored with the solid rock, on which the rest of the temple is erected. Great part of the eastern wall has fallen down, and both ends are greatly dilapidated. A stair leads from each end to the top of the propylon, from which passages go off into a number of chambers. The figures on the walls are very abundant, chiefly representing battle-scenes. There are fifty-six paces between the propylon and the of the temple. This space was probably enclosed with a high wall at each end, and formed the dromos; but no traces of the walls exist, except the rough marks of their junction with the propylon. In this dromos was found the broken statue of the hero to whom the building was dedicated, either Memnon or Osymandyas. The front wall of the temple is greatly dilapidated, and what remains of it does not indicate that imposing grandeur and profusion of ornament that generally characterize the façade of an Egyptian temple; but when we pass to the inside, the walls are seen adorned after the usual manner. The columns in front of the wall, forming the piazza, are formed in front into statues representing Osiris, with his hands crossed over his breast, holding the crook and scourge; the lower limbs closed up in the shape of a mummy, with a row of hieroglyphics passing down the front. Four of these statues are still remaining on the east side of the pronaos; they consist of seven stones each, and are about twenty-two feet high. There have been four on each side of the door of the pronaos, fronting an equal number on the opposite side of the court; that is, there were sixteen in all; while the northern and southern sides of the area have been bounded by two rows of colums, forming, with the sixteen Osiris columns, a magnificent piazza all round the court. Only two of these columns now remain on the northern side, and three on the southern: they are reeded at the base and at the top, and are twelve feet in diameter. In the rear of the eastern colonnade there are fragments of many statues, of black granite. Above eight or ten paces from this part of the building is an area, thirty-five paces long, between two ruined walls, which is filled up with a stupendous colonnade of eight rows of columns, six in each row, twenty-eight of which are still remaining. The ceiling consists of large flat stones, ornamented with hieroglyphics. The whole of this noble edifice, of which only a skeleton remains, has been two hundred feet wide, and six hundred feet long. It contained six courts and chambers, passing from side to side of the temple, which were ornamented with about one hundred and sixty columns, thirty feet high. All the side walls have been broken down, and the materials carried away.

About a quarter of a mile from the Memnonium, at the modern village of Medinet Abou, we find another large temple. Its gateway leads into a large walled court, crowded with stones in front of a large propylon, which appears to have been built out of a former edifice. Passing through this, we come to another and smaller propylon, which leads into a low square court, in the middle of which has been erected a christian church, many columns of which are still standing. Proceeding onward, we come to the principal part of the temple, which is adorned with a number of columns: it is an open court, with a number of side chambers, and, in the middle, a spacious insulated apartment, open at both ends. Beyond this chamber are two other apartments, occupying the middle of the building, with several side-chambers, all of them covered with sculpture and hieroglyphics, and painted in various colours, some of them still remarkably vivid. Attached to this temple, on the south, are the remains of what has been called a stately palace, though Dr. Richardson is disposed to consider them as a series of chambers built over the gateway leading to the grand temple, the original and regular entrance to which passes under and through the middle of it." Proceeding about three hundred and fifty feet in a direct line to the west of the gateway, over heaps of sand, and houses of unburnt brick, we come to the propylon of the grand temple at Medinet Abou. The propylon is about one hundred and seventy-five feet long, the temple itself is about five hundred and seven feet long, and the cella is about one hundred and forty-eight feet broad without the walls. The walls are covered with sculptures (chiefly battle scenes) and hieroglyphics. The dromos, in the interior, is a court of about one hundred and twenty feet square, having a piazza of nine columns on each side; extending to the second propylon, the columns, the ceiling, and the wall, all round, are covered with hieroglyphics and sculptures. Passing through the magnificent doorway of the second propylon, we enter the pronaos, which is an open court surrounded with a piazza, having eight columns on the east and west, and five on the other sides. The space occupied by the ruins attached to this temple is about a mile in circumference. At the south corner of ruins, there is another small temple, consisting of three small rooms. To the south east, near the village of El Barrat, is a strong embankment of earth, about five hundred feet thick, and from thirty to forty feet in height, enclosing an area of about two thousand feet square, supposed to have been an ancient reservoir for retaining the waters of the river for the supply of the city.

At Dair el Medinet, nearly opposite the Memnonium, there is another temple, consisting of a small propylon, with the small chambers, which are entered separately from the pronaos.

In addition to these temples on the west side of the river, there are traces and remains of many more; the walls of some levelled with the ground, and the greater part of the materials carried away.

All over the rocky flat, and in the face of the mountain in several places, recesses have been cut in upon the front of the elevation, and carried back so as to form three sides of a square, and numerous excavations have been made in the rock, with a piazza running all along the line of entrances. Each mansion consists of a large chamber, with a shuft passing from it, at the further extremity of which is a niche for the reception of a mummy case. These have been considered by many to be the dwellings of the earliest inhabitants of Thebes. About three-quarters of an hour from Gornou, on the other side of the mountains, is the valley of Biban-el-Melook, (the caves of the kings,) containing the vast excavated tombs of the ancient Theban monarchs.

The ruins on the east side of the river are far from being so interesting as those on the Libyan side: they consist almost entirely of the temples of Luxor and Karnac. The edifices are, however, on a grander scale.

The temple at Luxor, like the Memnonium, is a mere skeleton: the greater part of the columns in the interior, and part of the sanctuary, are still standing; but the outer walls have been thrown down, and the materials carried away. It is nearly 800 feet in length, and the propylon extending along the front measures in width about 200 feet at its present base, which is between twenty and thirty feet above the foundation. Behind the propylon is the dromos, a large open court, about 300 feet long, and 160 wide, surrounded with a piazza formed by a double row of columns, which appears to have been walled and covered in. A double row of stately columns, twelve feet in diameter, and between thirty and forty feet high, with spreading capitals, resembling the budding lotus, lead to the cella, which is peripteral, having a row of eleven columns on each side. We next come to another colonnade, consisting of ten rows of columns, three columns in each row; then to a cross wall, with a door-way in the middle of it; beyond which is another colonnade, consisting of eight rows of columns, four columns in each row, and leading to what may be regarded as the sanctuary of the temple. This communicates with several small apartments. Great and magnificent as is this temple, Dr. Richardson observes—"it only serves to show the way to an edifice much greater, to which it bears only the proportion of a lodge to a palace; I mean the splendid ruin of the temple at Karnac."

The distance from Luxor to Karnak is nearly two miles, and the whole road was formerly lined with a row of sphinxes on each side; for two-thirds of the way they are now buried under the rubbish; but in the latter part of the way, near to Karnac, they still remain on each side of the road. The regular approach to the temple, which is considerably more to the east, is likewise bordered by two rows of sphinxes, and then passes through four immense propylons. The gateways are chiefly of polished granite, and, as well as the sides, are covered with sculpture and hieroglyphics, and adorned with numerous colossal statues, placed at the distance of four or five hundred feet from each other. Entering by the side, the traveller is placed in the centre of this splendid ruin, where the astonished eye passes over the wrecks of a sacred edifice, extending about six hundred feet on each hand, the whole length of the temple being about twelve hundred feet, and four hundred and twenty feet in breadth. On the opposite side, there is also an entrance through a magnificent propylon, four hundred feet long and forty feet thick, approached by a double row of sphinxes. There is a staircase in the northern end, leading to the top; and a passage runs over the ceiling of the door-way, from the north to the south wing. This gateway leads into a spacious court, containing a double row of stately columns, forty feet high; a row of smaller columns passes down each side, and on the right a small temple projects considerably into the court. The columns in the middle of the court terminate in another propylon. To this propylon succeeds an immense colonnade, the columns running down the middle, being the largest. These supported the highest part of the roof, in the sides of which are small windows for the admission of light to this part of the temple. This colonnade brings us to the end of this half of the temple. The middle of this part of the temple is occupied by a sanctuary constructed of highly-polished granite. Beyond this is another very extensive colonnade. Many parts of this temple are completely concealed by the accumulation of rubbish. On every hand are gateways and adjoining temples, which, in other places, would be reckoned magnificent. There are also some ruins of a temple at the village of Medamoud.

Theodolite, an instrument used in surveying, for taking angles in vertical or horizontal planes.

Theologeion, (Gr.) In the theatres of the ancients, this name was given to a machine which was used to represent apparitions; it was placed in the upper part of the scene, and appears to have had some resemblance to the ekkyklema. By a particular process, applied in the interior, they displayed a part of the decoration of the stage above the scene, by which means the deities appeared to the eyes of the spectators: probably they were always surrounded with clouds, and, when they became invisible, they were entirely concealed by them.

Thesilium, the building at Megalopolis, in which the deputies of the different cities of Arcadia used to assemble, to deliberate on their affairs in common. It was so named from its founder.

Theseus, Temple of. See *Athenian Architecture.*

Tholus, (Gr.) a term given to buildings of a circular form. Vitruvius (iv. 7. and vii. 5.) uses it to signify the roof of a circular building. According to Suidas, the building at Athens, where the Prytanies used to assemble, was a tholus. A circular building at Epidauria was distinguished by the same term; and it was also applied to the laconicum of a bath, which was of a circular form.

Thoricus, one of the demi of Attica, in a plain on the eastern coast, which derived its importance from the vicinity of the silver mines of Lauricum. A little below a conical hill, which is supposed to be the site of the ancient citadel, are the remains of a Doric portico, with fourteen columns in the front, and seven in each return. No remains of a wall could be discovered within the area. The columns diminish nearly a fourth of their lower diameter, in straight lines. The shafts are plain, except a small portion, which is fluted at the top and bottom. (Unedited Antiquities of Attica.)

Thorough-lighted, a term applied to a room which has windows on two opposite sides.

Thymele, (Gr.) Suidas, explaining the word *σκηνη*, (scene,) says, that in the orchestra is the altar of Bacchus, which is called *thymele*, (θυμελη); and in another place he says, that the *thymele* was an altar, so called from the word *θυμειν, to sacrifice.* On the thymele, in front of the pulpitum, or logeion, were seated the musicians and choristers, as may be conjectured from some remains of seats cut out of the rock, at the back of the thymele, in the remains of an odeum at Athens. These musicians were called Thymelici, from the thymele on which they were seated or stood.

Thyroma, (Gr.) the doors of a temple or house.

Thyroreum, (Gr. from *θυρος, a door-way*, and *ουρος, a keeper*,) a passage in the Grecian houses, leading from the entrance to the peristyle, by the apartments of the porter.

Tie, (*tian*, Sax. *to bind*,) a timber, rod, chain, &c. binding two bodies together which have a tendency to separate or diverge from each other. The *tie-beam* connects the bottom of a pair of principal rafters, and prevents them from bursting out the wall.

Tierce Point, the vertex of an equilateral triangle.

Tiles, plates of clay, baked in a kiln, and used instead of slates for covering the roofs of houses.

"Two forms of tiles were used in ancient buildings. The *imbrex*, placed in regular rows to receive the shower, and the *tegula*, which covered and prevented the rain from penetrating the joints. The latter were finished at the eaves with upright ornaments, (*antefixas*,) which were repeated also at the junction of these tiles, along the ridge. These ornaments are called, by Pliny, *personæ*, from their being probably at first *masks*. He refers their invention to Dibutades, a Sicyonian potter, established at Corinth, who called them *protypes*, being stamped in front only: those upon the ridge, an after-thought of the same artist, and worked on all sides, were named *ectypes*." Pompeiana, p. 221. The tiles of the temple at Ecbatana were of silver. Among modern builders there are several kinds of tiles:—

Plane Tiles, or *Crown Tiles*, are such as have a rectangular form and plane surface, are 10½ inches long, 6 broad, and ½ thick, weighing from 2 to 2½ lbs.—*Ridge, Roof*, or *Hip Tiles*, are formed cylindrically, to cover the ridges of houses, are twelve inches long, ten broad, and ½ thick, and weigh about 4½ lbs. —*Gutter Tiles* are about the same weight and dimensions as ridge tiles.—*Pan-tiles* have a rectangular outline, with a surface both concave and convex, having no holes, but being hung on the lath by a ledge in their upper ends, formed in the making; they are generally 14½ inches long, and 10 broad, weighing from 5 to 5½ lbs.

The following are the results of some experiments on the advantages of slates over tiles, as related by the bishop of Llandaff. That sort of slate, other circumstances being the same, is esteemed the best, which imbibes the least water; for the water imbibed not only increases the weight of the covering, but, in frosty weather, being converted into ice, swells and shivers the slate. This effect of frost is very sensible in tiled houses, but is scarcely felt in those which are slated; for good slate imbibes but little water; though, when they are well glazed, tiles are rendered, in some measure, similar to slate in this respect. He took a piece of Westmoreland slate, and a piece of common tile, and weighed each of them carefully; the surface of each was about thirty square inches; both the pieces were immersed in water for about ten minutes, and then taken out and weighed, as soon as they had ceased to drip: the tile had imbibed about a seventh part of its weight of water, and the slate had not imbibed a two-hundredth part of its weight; indeed, the wetting of the slate was merely superficial. He placed both the wet pieces before the fire; in a quarter of an hour the slate was perfectly dry, and of the same weight as before it was put in the water; but the slate had lost only about twelve grains of water it had imbibed, which was, as near as could be expected, the very same quantity that had been spread over its surface; for it was the quantity which had been imbibed by the slate, the surface of which was equal to that of the tile: the tile was left to dry in a room heated to sixty degrees, and it did not lose all the water it had imbibed in less than six days.—The finest sort of blue slate is sold at Kendal for 3s. 6d. per load, which comes to £1. 15s. per ton, the load weighing two hundredweight. The coarsest may be had for 2s. 4d. a load, or £1. 3s. 4d. per ton. Thirteen loads of the finer sort will cover forty-two square yards of roof, and eighteen loads of the coarsest will cover the same space: so that there is half a ton less weight upon forty-two square yards of roof, where the finest slate is used, than if it was covered with the coarser kind, and the difference of the expense of the material is only 3s. 6d. A common Cambridge tile weighed thirty-seven ounces: they use at a medium seven hundred tiles for covering a hundred square feet, or about two tons and a half of tile to forty-two square yards. Hence, without including the weight of what is used for wrapping over, &c. when a building is covered with copper, lead, tiles, or slate, it will be seen that forty-two square yards of building will be covered by

	Cwt.
Copper	4
Fine slate	26
Lead	27
Coarser slate	36
Tiles	54

Mr. Malcolm thinks that tiles in a damp state, lodging on timber for at least six months, must injure the timber, and, together with the unburnt or place bricks in the wall, must produce an almost perpetual moisture, and make a house damp and unhealthy at all seasons.

M. de Chemas obtained, from the emperor of Russia, a patent for his improvements in bricks and tiles; which were, according to a Russian paper,—"(1.) a machine for converting every species of clay, immediately on being dug up from the pit, into tiles, or bricks—(2.) a furnace for burning tiles or bricks to the consistency of iron, with a saving of one-third of fuel—(3.) a press, with which three or four people may form ten to twelve thousand tiles or bricks in one day. This press furnishes the bricks or tiles in almost a dry state, perfectly free from cracks, and perforated with holes, in order to promote the drying, and to give the cement a better hold of them; while, by a very simple apparatus it may be so adjusted as to give the bricks or tiles any shape that may be desired; such as bent bricks for vaults or furnaces, or tiles for ornamental purposes. The tiles join, and, with the inventor's cement, are more durable than iron, by three-fourths less expense, and never require being varnished."

Timber. The species of timber chiefly used in carpentry and joinery, are oak, the different species of pine, mahogany, lime, poplar, ash, elm, beech, &c.

There are two species of *Oak* common to our island; but the best is that which Linnæus has named *quercus robur*, being of a finer grain, less tough, and not so subject to twist as the other kind. The foreign oaks, brought from the ports on the Baltic, from Germany, and from America, are in general preferred to our home species, from their being more free from knots, of a straighter grain, and less difficult to work.

Oak is most durable, when it has taken the longest time to arrive at maturity. In a damp situation oak decays gradually from the outside to the centre; but when, on the contrary, its decay is caused by its great age, and commences while the tree is standing, it always begins from the centre, which is the oldest part.

Ash, is generally toughest on the outside.

Elm, is very liable to warp and shrink, and is generally cross-grained: but it is not liable to split, and it consequently bears the driving of bolts and nails better than most timbers.

Beech, is hard and close, but not durable, particularly when exposed to moisture.

Poplar, is not durable, but is

close, and in general well adapted for floors and stairs.—*Asp* resembles poplar in appearance, but is soft, tough, and tolerably durable.

Lime and *Sycamore*, also resemble poplar, and are liable to the same objections.

Birch, is very regular in quality, tough, but not durable in an exposed situation.

The timber of the Spanish or edible *Chesnut* is sometimes found in old buildings, and is not easily distinguished from oak.

Walnut, is seldom used, except for gun-stocks, &c.

Mahogany, is chiefly used in furniture: that from Jamaica is the hardest and most beautiful.

The most useful wood in England, next to oak, is *Fir*, of which there are two principal kinds, the Memel, including that of Dantzic and Riga, and the Norway, which also includes the Swedish. The *White Deal*, called by the Scotch *Pinewood*, is chiefly used by cabinetmakers. Evelyn, speaking of fir, observes, that "that which comes from Bergen, Mott, Longland, Dranton (called *Dram*,) being long, straight, and clear, of a yellow and more cedary colour, is esteemed much before the white for flooring and wainscot; for masts, those of Prussia, which we call *Spruce*, and Norway, especially from Gottenburgh, and about Riga, are the best."

People who work in wood on a small scale, find a great difference in the materials according to the different times of the year when it is cut down. The wood of the pear-tree, cut in summer, works the toughest; holly, on the contrary, works toughest when cut down in winter; box is mellowest when cut in summer, but hardest when cut about Easter. Wood, contrary to what is the case in metals, is found to be longest in cold weather and shortest in hot which is owing to the remains of the sap yet in the wood, which being condensed by cold, is enlarged in its surface, and shrinks into less space again when liquefied by heat. Hence it appears, that all wood must change its surface more or less, according as it contains more or less sap; and this may be made a test of great use for the determining which kinds of wood have most, and what least sap. It is well known that wood contracts less in proportion in diameter, than it does in circumference; and from that cause a whole tree always splits in drying. Mr. Knight has shown, that in consequence of this irregular contraction, a board may be cut from a tree, that can scarcely by any means be made to retain the same form and position, when subjected to various degrees of heat and moisture. He cut some thin boards from the ash and the beech, in different directions relatively to their transverse septa, so that the septa crossed the middle of some of the boards at right angles, and lay nearly parallel with the surfaces of others. Both kinds were placed in a warm room, under perfectly similar circumstances. Those which had been formed by cutting across the transverse septa, soon changed their form very considerably, the one side becoming hollow; and, in drying, they contracted nearly fourteen hundredths in width. There is another kind of contraction to which wood is liable while drying, which causes it to become curved in the direction of its length, and is often observed in the long styles for framing, &c. Mr. Knight accounts for it by showing, that the interior layers of wood, being older, are more compact and solid than the exterior layers of the same tree; consequently, in drying, the latter contract more in length; and it may be avoided by cutting the wood so that the parts of each piece shall be as nearly as possible of the same age.

Difference of atmosphere also makes a considerable change in the bulk of wood. It appears, from Rondelet's experiments, that in wood of a mean degree of dryness, the extent of contraction and expansion, produced by the usual changes in the state of the atmospheres, was, in fir, from $\frac{1}{360}$ to $\frac{1}{75}$ parts of its width, and in oak from $\frac{1}{412}$ to $\frac{1}{84}$ part of its width. The mean extent of variation in fir is, therefore, $\frac{1}{124}$, and in oak $\frac{1}{140}$; consequently, in a fir board about 12½ inches wide, the difference in width would be one-tenth of an inch.

The following observations on timber, by Evelyn, are many of them well worthy of attention.

"Lay up your timbers very dry, in an airy place, yet out of the wind or sun, and not standing upright, but lying along, one piece upon another, interposing some short blocks between them, to preserve them from a certain mouldiness which they usually contract while they sweat, and which frequently produces a kind of fungus, especially if there be any sappy parts remaining.

"Some there are yet, who keep their timber as moist as they can by submerging it in water, where they let it imbibe, to hinder the cleaving; and this is good in fir, both for the better stripping and seasoning; yea, not only in fir, but other timber. Lay, therefore, your boards a fortnight in the water, (if running the better, as at some mill-pond head,) and there setting them upright in the sun and wind, so as it may freely pass through them, (especially during the heats of summer, which is the time of finishing buildings,) turn them daily; and, thus treated, even newly sawn boards will floor far better than many years' dry-seasoning, as they call it. But to prevent all possible accidents, when you lay your floors, let the joints be shot, fitted, and tacked down only for the first year, nailing them, for good and all, the next; and by this means they will lie staunch, close, and without shrinking in the least, as if they were all one piece. And upon this occasion, I am to add an observation, which may prove of no small use to builders; that if one take up deal boards that may have lain in the floor a hundred years, and shoot them again, they will certainly shrink, (*toties quoties*,) without the former method. Amongst wheel-wrights, the water seasoning is of especial regard; and in such esteem amongst some, that I am assured the Venetians, for their provision in the arsenal, lay their oak some years in water before they employ it. Indeed, the Turks not only fell at all times of the year, without any regard to the season, but employ their timber green and unseasoned; so that, though they have excellent oak, it decays in a short time by this only neglect.

"Elm, felled ever so green, for sudden use, if plunged four or five days in water, (especially salt water,) obtains an admirable seasoning, and may immediately be used. I the oftener insist on this water seasoning, not only as a remedy against the worm, but for its efficacy against warping and distortions of timber, whether used within, or exposed to the air. Some again, commend burying in the earth; others, in wheat: and there be seasonings of the fire, as for the scorching and hardening of piles, which are to stand either in the water or in the earth.

"When wood is charred, it becomes incorruptible; for which reason, when we wish to preserve piles from decay, they should be charred on their outside. Oak posts, used in enclosures, always decay about two inches above and below the surface. Charring that part would probably add several years to the duration of the wood, for that to most timber it contributes much to its duration. Thus do all the elements contribute to the art of seasoning.

"Timber which is cleft is nothing so obnoxious to reft and cleave as what is hewn; nor that which is squared, as what is round: and, therefore, where use is to be made of huge and massy columns, let them be bored through from end to end. It is an excellent preservative from splitting, and not unphilosophical; though, to cure the accident, painter's putty is recommended; also, the rubbing them over with a wax cloth is good; or, before it be converted, the smearing the timber over with cow-dung, which prevents the effects both of sun and air upon it, if of necessity it must lie exposed. But, besides the former remedies, I find this for the closing of the chops and clefts of green timber, to anoint and supple it with the fat of powdered beef broth, with which it must be well soaked, and the chasms filled with sponges dipt into it. This to be twice done over.

"We spake before of squaring; and I would now recommend the quartering of such trees as will allow useful and competent scantlings, to be of much more durableness and effect for strength, than where (as custom is, and for want of observation,) whole beams and timbers are applied in ships or houses, with slab and all about them, upon false suppositions of strength beyond these quarters.

"Timber that you have occasion to lay in mortar, or which is in any part contiguous to lime, as doors, window-cases, groundsels, and the extremities of beams, &c., have sometimes been capped with molten pitch, as a marvellous preserver of it from the burning and destructive effects of the lime; but it has since been found rather to heat and decay them, by hindering the transudation which those parts require; better supplied with loam, or strewings of brick-dust, or pieces of boards; some leave a small hole for the air. But though lime be so destructive, whilst timber lies thus dry, it seems they mingle it with hair, to keep the worm out of ships, which they sheathe for southern voyages, though it is held much to retard their course.

"For all uses, that timber is esteemed the best, which is the most ponderous, and which, lying long, makes deepest impression in the earth, or in the water, being floated; also, what is without knots, yet firm, and free from sap, which is that fatty, whiter, and softer part, called by the ancients *alburnum*, which you are diligently to hew away. My Lord Bacon, Exper. 658, recommends, for trial of a sound or knotty piece of timber, to cause one to speak at one of the extremes to his companion, listening at the other; for if it be knotty, the sound, says he, will come abrupt."

The durability of buildings depends much on the goodness of the timber, and the manner in which it is applied. It must, in the first place, be selected from such as has been cut down in the season of autumn, when there is not much sap in trees, and consequently the timber not liable to shrink quite so much in drying, and by experience found less liable to the dry rot. After the trees are cut down, they must remain till the succeeding spring, at least, before they be cut into scantling timber and boards; after which, it will be necessary to keep them exposed to the sun and air till sufficiently dried. Boards, to be seasoned, ought to be piled upright, with their upper ends resting between racks, and the scantlings dried in the same manner; or, according to the custom of others, the planks and boards are arranged so that the ends rest on each other, forming in each pile alternate vacancies to admit the air between each. If the timber be allowed to lie close together, the accumulated sap and moisture will ferment, and produce what is called the dry rot. To preserve timber which is in the foundations of buildings, or exposed to moisture and the weather, the process of charring is found importantly useful. This is done either by exposure to fire, or by coating with pitch, which is afterwards set fire to, and turned round as it burns; and sometimes a coat of tar is applied after charring has been performed. For paling and weather-boarding various methods are used, among which are the following:—Mix, with six pounds of melted pitch, one pound of red ochre, one pound of grease, and a little lamp black, and apply hot when the wood is quite dry; or take eight pounds of tar, two pounds of fine sand, with a little red lead and soot. The following will be found superior to either, and will also prove a very cheap and durable paint for out-door work:—To a gallon of common fish oil, add lime till of a proper consistence, with a sufficient quantity of yellow ochre and lamp black, to give a proper colour; dilute with linseed oil, and use as a paint.

To preserve the joints of frame-work exposed to the weather, take one pound of pitch, a quarter of a pound of grease, and as much powdered chalk as will make the boiling mixture of a proper consistence. The mortise and tenon must be covered with this while hot, and then secured by pins.

The following remedy against dry rot has been published by Mr. Baker, of Hampstead:—Take two ounces of white arsenic in powder, dissolve it by boiling in one gallon of soft water; if boiled in an iron or tinned vessel, add half an ounce of copper filings, but if in an untinned copper vessel, the filings are unnecessary; to a quart of size and half a pound of tar, add a small quantity of fresh-slaked lime, sifted pretty fine; beat them well into a paste, which is to be dissolved with the above solution, gradually adding during the process, by small portions, as much more of the pulverized lime as will give the whole a proper (rather diluted) body to be laid on with a painter's brush. New work, when finished, as a preventive, should be dressed with the composition at least twice, after well drying the first coat.

The contact of water and air are the chief causes of the decay of wood; therefore, if any means can be devised to prevent the access of air and moisture, the wood may be secured from decay. This principle may be illustrated by supposing a cylinder of dry wood to be placed in a glass or case which it exactly fills, and the two ends of which are, as it is called, hermetically sealed, or entirely close. Such a piece of wood might remain, so enclosed, in the open air, for a thousand years without any change. To exclude air and moisture, various expedients have been employed; the most common is covering the wood with a coating of paint, or oil-colour, which is with difficulty penetrated by air or moisture; but the composition which experience has proved to be the best adapted for the preservation of wood from both species of decay, either wet or dry rot, is as follows: Melt twelve ounces of rosin in an iron pot or kettle; when melted, add twelve ounces of roll-brimstone, and just when both are in a liquid state, pour in three gallons of train or whale oil. Heat the whole slowly, gradually adding four ounces of bees' wax, cut into small pieces; frequently stir the mixture, and, as soon as the solid ingredients are dissolved, add as much Spanish brown, or red or yellow ochre, or any other colour, (first ground fine with some of the oil,) as will give the whole a deep shade. Lay on this paint or varnish as hot and thin as possible, and, some days after the first coat becomes dry, give it a second. What remains unused will become solid on cooling, and may be remelted for future occasions.

A patent was granted to Joseph Bramah, of Pimlico, for the application of Parker's cement to timber to prevent the dry-rot, and to arrest its progress, where decay has commenced: this is done by mixing the powder, so called, with water, to the consistence of white-wash, and applying it to the surface of the timber, previously freed from impurities.

A valuable treatise on the decay of timber, by Dr. Parry, is inserted in the thirteenth volume of the Repertory of arts, for 1808, which was originally published in the Bath and West of England Societies' papers.

The steeping, or washing timber with brine of the salt-springs, is recommended as efficacious for this purpose.

A correspondent, in the second volume of the Mechanics' Magazine, recommends the following mode of preventing the dry-rot, the success of which has been evinced by experience. It is, to bark the tree in spring, and at the same time to lop off every branch too small or unfit for timber. Then, through the bottom of the trunk, bore two holes, of about one inch and a half in diameter, so as to cross each other. Through these the sap would run out so as to kill the tree, and, by seasoning in an unright position, all the aqueous matter would be completely removed, which, by laying on the ground, cannot be done, except within two or three feet of each end. If the tree were then cut down in the ensuing winter, timber would be found of a remarkably hard and dry quality, so as indeed almost to resist the saw, and be at the same time free from rent or shake. Oak timber is, on the contrary, generally seasoned by lying on the ground after being felled, though sometimes more from necessity than choice; labour, to remove it, in the spring or summer being dear, it is suffered to lie till winter, whilst the sap on the lower side rots off a considerable portion of the wood, and the upper side is rent by exposure to the sun and wind.

Table of the specific gravity of different woods.

Alder	800
Apple Tree	661
Ash, trunk of	845
Beech	852
Box, Dutch	1328
—— French	912
Brazil wood, red	1031

Cedar	596
Cedar, American	560
Cherry Tree	715
Cork	240
Cypress, Spanish	644
Ebony	1331
Elder Tree	695
Elm	671
Filbert Tree	600
Fir	498 to 550
Lignum-vitæ	1333
Logwood	913
Mahogany	1063
Maple	750 to 755
Medlar	944
Mulberry, Spanish	897
Oak, heart of, (60 years)	1170
Olive	927
Orange Tree	705
Peruvian Bark	784
Plum Tree	705
Pomegranate Tree	1354
Poplar	383
——, White Spanish	529
Quince Tree	793
Sassafras	482
Vine	1327
Walnut	671
Willow	585
Yew, Dutch	788
—— Spanish	807

Ting, see *Chinese Architecture.*

Tiryns, see *Acropolis, Cyclopean Architecture.* In our plan of Tiryns, (pl. *Acropolis,*) the following references have not been described in the article to which it belongs, *a*, the great gate; *b*, ascent to the gate; *c*, a tower; *d*, present entrance and ruined wall; *e*, galleries, where they are now visible; *f*, a gate; *g*, ascent to the gate; *h*, galleries; *k*, cistern; *l*, pedestal; *m*, gate.

Tomb, a funeral monument raised over the remains of the dead. The Romans designated by the word *sepulchrum*, the place where the entire body, or, when the custom was to burn them, the ashes of the dead were deposited. Besides the simple sepulchres, they had also more magnificent tombs, under the names of *monumenta*, *mausolea*, *sepulchral vaults*, &c.

The earliest kind of tombs appear to have been grottos and caverns. In the plains of Etruria, many sepulchral grottos have been found, hollowed in a rock, which is not difficult to work. They are sometimes disposed in form of a cross, or with three wings, almost like our churches; others are squared in different proportions. Doors have been formed, to lead from one grotto to another; sometimes they are above each other. These grottos are not very deep. The interior is often adorned with paintings.

When, after having constructed a tomb, the funeral was celebrated without interring a corpse in it, it was named a *cenotaph*.

There were, among the Romans, family tombs and hereditary tombs; and others which had no particular destination. The *family tombs* were those which a person caused to be made for himself and his family. *Hereditary tombs* were those which the testator constructed for himself and for his heirs, or for those who might come into possession by right of heritage. Any one might appropriate to himself a particular tomb; he could also hinder, by his will, any of the heirs of his family from being interred in the family tomb. For that purpose they engraved on the tomb the letters H. M. H. N. S. that is, *hoc monumentum hæredes non sequitur*; or, H. M. AD. H. N. TRANS. that is, *hoc monumentum ad hæredes non transit*, which signified, that the disposal of the place where that tomb was erected, and the tomb itself, formed no part of the heritage. Ancient sepulchral inscriptions show us what precautions were taken to defend the tombs in the different changes of proprietors. Besides the imprecations which were published against those who might dare to violate the will of the testator, the laws established great penalties. The sepulchral inscriptions also show us, that not only the spot occupied by the tomb was considered sacred, but that a space round it enjoyed the same privilege.

After the decline of the arts, the tombs were simply great stones, on which was cut with a chisel a rough effigy of the dead; or it was figured in a kind of Mosaic, with different-coloured stones, as on the tomb of Fredegonde, at Sainte Germain des Prés, which may be seen in the Musée des Monumens Français; or it was represented in enamel, as were the tombs of the counts of Champagne at Troie, and those of the children of St. Louis at Royaumont, which are figured in Millin's Antiquités Nationales, tom. ii. art. 11. Sometimes, instead of marble or stone, was substituted a plate of copper, sometimes enamelled, but more frequently engraved. The deceased is represented in the habit which he wore whilst living; sometimes with the monastic habit, with which he wished to be covered on the day of his decease; his hands are joined. Some animal, which was a favourite, which made part of his arms, which designated his power, or which had an allegorical signification, is under his feet; two angels, near the pillow on which he rests his head, announce his admission into heaven. Around the border is the inscription. The same representations are found on elevated tombs. The dead are figured in the same manner, extended on a square base, sometimes appearing to be asleep. Sometimes, but more rarely, the body is naked, and appears to be embalmed, as in the tomb of Francis I. which was at St. Denys, and which is now in the Musée des Monumens Français; at other times the body appears in a state of putrefaction; as in the fine bas relief of Jean Goujon, which still remains at Gisors; at other times it is almost entirely devoured by worms. (See Millin, Atiq. Nationales, tom. iv. p. 10.) In elevated tombs the sides receive a variety of ornaments, such as representations of the funeral ceremonies, figures of angels, evangelists, saints, and frequently the children of the deceased. Sometimes some celebrated actions of the deceased were represented, or some group of an allegorical signification.

After the revival of the arts, the tombs of princes and great men have opened a vast field for sculpture. The monuments, instead of being square, with the sculptures on an horizontal face, have been changed to upright groups, sometimes of saints or allegorical figures, at other times historical; and the figure of the deceased, instead of being placed in a reclined position, is figured in a position which refers to some action of his life—a warrior leading his soldiers, or receiving his mortal wound; a statesman in a declamatory position, &c. In the church of the village of Hindelbank, near Berne, we have a fine allegorical monument, which was sculptured by Nahl. It is the tomb of a beautiful and virtuous lady, who died in child-birth. The monument represents a simple tomb, covered with a common stone. But as we approach, we discover all of a sudden the scene of the last day, when the earth is to render up its dead. The stone which covers the tomb is cleaved through the middle, as though by the effect of a great commotion of the earth. Through this cleft we perceive the mother and her child, whose look and attitude announce the holy beatitude of which they are going to be partakers. The mother holds her child, which appears likewise to be returned to life, in her left arm, and with her right raises the stone, that she may come out of the tomb. On the border of the stone are engraved these words—*Me voici, Seigneur, avec l'enfant que tu m'avais donné.*

For further particulars relating to tombs, see the article *Sepulchral Monuments.*

TOMBELLAS, the name given in France to the ancient Gaulish tumuli, which are found in various parts, and which are in England called *barrows.*

TONDINO, a round moulding, representing a ring, the same as the *torus.*

TONGUE, (Sax.) the part of a board which is left projecting, to be inserted in the groove of another.

TONGUE, see *Egg and Tongue.*

TOOLS. The principal instruments, used by masons for hewing stones, are the *mallet* and *edge tools.* The latter have the form of a wedge, the vertical angle being the cutting edge. These tools are made of iron, with the exception of the end which enters the stone, which is of steel. The other tools used by the mason are the *level, plumb-rule, square, bevel,* and *rules* both straight and circular, of various kinds, for trying the surface of the work.

In London, the tools successively used to work the face of a stone, are the *point, inch-tool, boaster,* and then the *broad-tool.* Working with the point is called *pointing;* and with the boaster, *boasting.* The inch-tool is used in cutting away the ridges, and the boaster is used to make the surface of the work nearly smooth; the latter is two inches wide in the cutting part. The point is from one-eighth to three-eighths of an inch wide, and the broad-tool three inches and a half at the cutting edge. There are two methods of working the surface of a stone commonly used. In one operation, the successive impressions made by the whole breadth of the tool follow one another in the same straight line, the whole length or breadth of the stone; their successive equidistant parallel lines are repeated in the same manner, giving the surface of the stone the appearance of being fluted. This mode of hewing is called *stroking.* In the other mode of operation, every successive impression is repeated in new equidistant lines throughout the length or breadth of the stone; then a new series of impressions is repeated by the side of it, until the surface is covered. This is called *tooling.* In some parts of the country different fancies of hewn stone are indulged, as *herring-bone work,* which consists in parallel zig-zag lines. In Scotland there are other kinds of work, which are termed *droved, broached,* and *striped.* Droving is the same as that which in England is termed *random tooling,* or which is called in London *boasting:* the tool they use is called a *punch,* and is the same as the point. Broached work is first droved, and then broached. Striped work is first droved, and then striped.

When stones are very unshapely previous to being hewn, the *stone-axe, jedding-axe, scabbing-hammer,* or *cavil,* is used, to bring the stone nearly to the required shape. One edge of the jedding-axe is flat, for reducing the very protuberant angular parts; the other end is pointed. In Aberdeen, where a kind of hard granite is generally used, they pick the edge of the stone with a scabbing-hammer, and the operation is termed *nidging*. When the surface is smoothed by means of sand or grit stone, it is called *rubbed work*.

The tools, used in setting or building, are a *line* and *line-pins*, the *level*, the *plumb-rule*, and various other rules, as also *templets* for circular work.

Among carpenters and joiners, a great number of different tools are used.

The operation of forming a plane surface, by taking away the superfluous wood, is called *planing;* and the instruments by which it is performed, *planes*. Of planes there are many different kinds. Under the head of *bench planes*, are included the *jack plane*, the *trying plane*, the *long plane*, the *jointer*, and the *smoothing plane*. There are also planes for forming surfaces of nearly every curve or shape, which are named *rebating planes*, *grooving planes*, and *moulding planes*. The plane employed in cutting a square groove is called a *plough*. To form the convex and concave surfaces of the rims of wheels, &c. the sole of the plane is curved in the same form, and the plane is termed a *compass plane*. A convex plane is also sometimes termed a *round sole plane*, and a concave one a *forkstaff plane*.—For a further account of different kinds of planes, see the articles *Plane* and *Planing Machine*.

In plate *Tools*, *figs*. 14, 15, 16, 17, and 18, are descriptive of an economical set of planes invented by Mr. G. Gladwell, carpenter, of Lower Garden-street, Vauxhall, whom the Society of Arts rewarded for the invention. The object is to make one plane answer the purpose of the *pannel*, *jack*, and *smoothing planes*, also of *hollows* and *rounds*, and various *moulding planes*.

For this purpose the upper part of Mr. Gladwell's plane is constructed in the usual manner; and to adapt the lower or working part to its several uses, a number of shifting soles, answering to the varieties above mentioned, are provided, which are attached, as may be required, to the upper part by means of a dovetailed groove; and the workman, being in possession of eight soles, flat, concave, or convex, in different degrees and directions, and of five irons, has an equivalent for eight separate planes; whereby a great saving of expense is made, as well as an increased portability acquired. The same letters in each of the figures refer to the same parts.

Fig. 14 is a side view of the plane; *k k* the sole or bottom portion of the plane fitted to the upper part *l l* by a longitudinal dovetail *m m*, shown by dotted lines; *n* a plate of brass screwed to the bottom piece *k*, to prevent its going too far, and *o* a plate of brass screwed to the upper portion *l l*, to stop the end of the dovetail.

Fig. 15 is an end view of the upper and lower pieces separate, to show the dovetail and groove.

Fig. 16 is a concave sole.

Fig. 17 a convex sole, with the brass plate *n* screwed on.

Fig. 18 a longitudinally convex sole.

The following are the directions of the inventor relative to the construction of the plane:—

Let one-third of the height of the plane be the thickness of the sole, having a dovetail fillet, (worked in solid, or glued and screwed on,) about three-eighths of an inch thick, and two inches wide. In the upper part of the body of the plane make a fillet for the groove to slide in. The sole slides in from the front of the plane, and secures itself against two brass stops or plates, one screwed on the back part of the plane, the other on the sole in front. The one on the back part answers for all the soles that may be fixed; but each sole must have one in front.

For boring cylindrical holes, the tools are *augers*, a *stock*, with *bits* of various descriptions and sizes, *gimlets*, and *brad-awls* of several diameters.

The *auger* (pl. *Tools*, *fig.* 19.) bears some resemblance to the gimlet. It has a great inconvenience, which is, that it cannot be used till a previous perforation has been made in the wood; and even then, till it has proceeded a considerable depth, it requires great care to hinder it from going astray. An improvement upon it, by Mr. Phineas Cooke, was rewarded by a premium of thirty guineas by the Society of Arts. It consists in being pointed by a worm-screw like a gimlet, and in having its body formed by a rectangular bar of steel twisted in the shape of a bottle-screw, whence it has been termed the *spiral auger*. A later improvement terminates, like the spiral auger, in a gimlet screw; immediately above, it is of a prismoid shape, tapering a little outwards; this part has one edge which cuts the side of the hole, and another which cuts the bottom. The core rises in the form of spiral shavings.

The *stock* is a kind of crank, generally of wood defended by brass, with two short limbs proceeding from it, at the end of one of which there is a hole to receive the *bit*, or piece of steel employed in boring. The bits are of various forms: the *gouge bit*, used for boring small holes in soft wood, is shaped like a gouge; the *centre bit*, has a point projecting from the lower end, which, entering the wood first, serves as a centre, and preserves the tool straight in its course. The *counter-sink*, is a kind of bit for widening the upper part of a hole, to admit the head of a screw.

The tools used in paring wood obliquely, or across the fibres, &c. are called *chisels;* those for paring the wood across the fibres, are called *firmers*, or *paring chisels;* such as are used in cutting rectangular cavities are called *mortise chisels;* those used for paring concave surfaces, are named *gouges*.

For dividing wood, so as to waste as little of the material as possible, an instrument is used called a *saw*, of which there are several different kinds, that are described more fully under the article *Saw*.

For cutting off the superfluous wood at the edges, &c. of a piece of board, the joiner frequently uses a small axe, called a *hatchet*.

For trying right angles, the instrument used is termed a *square;* those for trying obtuse or acute angles are called *bevels:* the former has generally its two sides fixed; in the latter they are moveable. A stationary bevel is sometimes used, which is termed a *joint-hook*. See *Bevel*.

When it is required to reduce a piece of wood to a parallel breadth, it is marked by an instrument called a *gauge*, which consists of a square piece of wood, with a square mortise, though which a bar slides at right angles, with a sharp point or tooth at the extremity, by means of which a parallel line is marked on the wood which it is required to cut. The stem, or sliding-bar, has sometimes another sliding-bar in it, with a point, which may be adjusted to any distance from the other point, so that two lines may be drawn, both parallel to the edge of the board, and consequently to each other.

To saw a piece of wood across the fibres, it is necessary that it should be kept stationary whilst sawing, for which purpose joiners use a flat piece of wood with two projecting knobs on the opposite sides, one at each end, called a *side-hook*.

To cut a piece of wood to half a right angle, (called a *mitre*,) a trunk of wood with three sides is used, resembling a box without ends: through each of the opposite sides is cut a kerf in a plane perpendicular to the bottom, at angles of forty-five and one hundred and thirty-five degrees with the planes of the sides: this is called a *mitre box*.

To fix wood, &c. while working, various instruments are used, as *screw-wrenches*, &c.

In pl. *Carpentry*, C. 44, *fig*. F, represents a longitudinal section of an improved screw-wrench, invented by Mr. Thomas Eddy, of Oxford street. The screw-wrenches in general use are actuated by a screw which passes up the middle of the handle, which so much weakens them, that they are frequently broken in that part, when used in heavy work; and the chaps are liable to open, and be loosed from their hold, by the handle turning round. These defects are obviated by Mr. Eddy's contrivance, and the instrument is rendered much stronger, more effective, and more compact. The screw is inserted in the sliding part instead of the handle, enabling the latter, in consequence, to bear any requisite strain, and removing the tendency of the chaps to open and shut. *a* is the fixed chap, *b* the fixed bar, *c* the moveable chap which passes through and slides up the bar *b*, *d* the moveable bar fixed to the chap *c*. This bar has a hollow barrel, screwed at its orifice, in which the solid thumb-screw *f* works. At the extremity of the bar *b* is formed a shoulder, on which rests the square piece *g*; or the bar may be turned up at right angles, forming a short projecting leg, which will answer the purpose of the piece *g*, and will be both stronger and cheaper. A square hole is to be made at *g* to admit the screw *f*, and this hole is to be contracted in one part by the insertion of two square pins, *i* and *h*, which confine the neck of the screw so as to allow it to turn round, but not to move backwards or forwards: *e* is a plate of iron wrapped round the end of the instrument, in order to keep the parts in their proper places, and to prevent the screws from being choked with dirt. Hence it is obvious, that when the screw *f* is turned in one direction, the barrel *d*, with the chap *c*, is pushed towards the chap *a*, and that it is withdrawn when the screw is turned in the opposite direction.

Fig. E is another instrument for the same purpose as the screw-wrench, and may be termed a *sliding-wedge-wrench*. It is the invention of a Mr. Francis Watt, engineer, who died on the very day that his invention was brought (through the instrumentality of the ingenious Mr. Smart, of Pedlar's Acre, Lambeth,) before the Committee of the Society of Arts. The sum of ten guineas was, in consideration of the excellence of the invention, presented to Mrs. Watt, the widow of the deceased. *i i* is the fixed bar terminated by the fixed chap *h*; *j j j* is an iron case enclosing, and fixed firmly on, the bar *i i*; *k* is the sliding chap, having a hole cut in it for the bar *i i* to pass through, and secured to the sliding bar *l l*. It will be observed that the lower end of this bar is cut off very obliquely, so as to form a long low wedge. *m n* is another low wedge.

To make use of this instrument, the wedge *m n* is to be withdrawn, the chap *k* is to be moved on the bar *i i*, till the screw-head, or other object to be acted upon, is closely embraced between the two chaps; the lower wedge is then to be driven home. The long line of bearing that the two wedges have on each other renders it impossible that they should give way, and a very slight tap at the point of the wedge will be sufficient to disengage it. A pin should be inserted at the point of the wedge at *m*, to prevent its slipping out and being lost.

The different parts of cutting tools have also their peculiar names.

Basil, is the name given to the edge of a chisel, plane iron, or similar slanting edge of a tool.

Fang, is the part of a chisel, or other iron instrument, which is drawn out and sharpened, to be inserted in the handle.

Fence of a plane, is the guard which regulates the inclination of cutting iron.

Fine set, is a term applied to a plane adjusted to a slight projection of the edge of the knife, to make it cut a fine shaving; when the projection is considerable, the plane is said to be *rank set*.

The broad part of a plane knife forming the edge, is called the *web*.

The tools used in quarrying have been described under the article *Quarry*, and others will be found described under their respective articles.

The tools used in tiling are—the *lathing hammer*, with two gauge marks; the *lathing staff*, in the form of a cross, for slaying the cross laths; the *tiling trowel*, which is longer and narrower than the common trowel; the *bosse*, a wooden instrument, with an iron hook for hanging on the laths, &c.; the *striker*, a piece of lath used to separate and take away the superfluous mortar at the breeches of the tiles; and the *broom*, to sweep the tiling

TOP-BEAM, *wind-beam*, or *strut-beam*, other names for the *collar-beam*.

TOR, (Sax.) a tower, or steep eminence. This term is often applied to hills in Somersetshire and Derbyshire, as *Glastonbury Tor*, and *Mam Tor*. Both these places are supposed to have been originally fortified.

TOREUMATA, (Gr.) that description of work, particularly vases, which was ornamented in bold relief.

TOREUTIC, (Gr.) the art of sculpturing, or engraving in relievo.

TORSELS, the same as *Tassels*.

TORSO, (Fr. *torse*,) a name given by artists to all mutilated statues, of which nothing remains but the trunk. The term is also applied to columns with twisted shafts, as the beautiful examples in the altar of Val de Grace. Of this kind of columns there are several varieties: some are *fluted*, the flutes following the contour of their shaft in a direct line, in its whole length; others are *rudented*, their shafts being covered with rudentures, in the manner of twisted cables. Some columns of this kind are adorned with branches, leaves, &c.

TORUS, (La .) a large semicircular moulding used in the bases of columns.

TORUS OF A BULWARK, the large semicircular moulding at the base of a fortified edifice.

TOUT-ENSEMBLE, (Fr.) The expression *ensemble* is generally used of a single figure. The term *tout-ensemble*, is used when speaking of a whole composition. Objects and parts, which would be beautiful by themselves, frequently injure the tout-ensemble.

Tower, (*tor*, Sax. *turris*, Lat.) a lofty building, of several stories, frequently round, and as frequently square or polygonal, which flanks the walls that encircle a city or castle. The tower of a church is that part which rises above the rest of the building, and contains the bells. See *Castle*, *Round Tower*, *Steeple*, *&c.*

Town, (Sax.) To give an exact definition of a town, we may say that it is a space enclosed by walls, containing several quarters, streets, public places, and other edifices. The first towns were a collection of cottages, or rather of caves. A curious example of a town formed by caves in the rock is still to be seen at Ispica in Sicily, and is described by Denon. In Egypt the towns were seldom walled. In Greece and Italy, and other countries, the earliest towns were probably only larger fortresses, in which the people, who dwelt scattered over the country, sought shelter in time of invasion by a foreign power. Hence they were generally seat on a rock, or some strong situation. After the people became civilized, and the numerous petty states were joined in powerful kingdoms, the towns were enlarged, and more frequently built on the plain. The town of the ancient Gauls and Germans was a strong hold, situated in the very heart of a great forest, and served for a place of resort in time of danger. That towns may be handsome, it is requisite that their streets should be wide, and laid out with regularity. They should always, if possible, cross one another at right angles, that the corner houses may be square. In large towns, squares are very requisite, and the largest should be in the centre, where all the principal streets meet. When walled, the principal streets should lead to the gates.

Town Hall, a building erected for purposes very similar to those which were anciently appropriated to the *basilica*, generally situated in the most central, open, and public part of a town or city. In his "Recueil et Paralléle des Edifices anciens et modernes," M. Durand has given us drawings and plans of several town-halls. That of Brussels, which is upwards of four hundred years old, is in a sort of Gothic-Saxon style, presenting great unity and simplicity of plan. It has a light and airy appearance, and at the same time has sufficient solidity, as is proved by its age. The spire in the centre is more in the modern Lombard style of architecture.

Trabeation, another term for an entablature.

Trabs, (Lat.) the Roman name for a wall-plate.

Tracery, in Gothic architecture, the intersection in various forms of the mullions in the head of a window or screen. See *Gothic.*

Trajan's Column, see *Column.*

Trajan's Arch, see *Triumphal Arch.*

Transept, an open passage or way across the body of the church in the direction of north and south, either on the eastern or western side of the nave; in some churches, on both. These transepts are broader than what are called aisles, and there generally is an oratory or chantry at their extremity, sometimes denominated the north and south transepts.

Transept Tower, that over the transept, to distinguish it from others.

Transom, a beam across a double-lighted window: if the window have no transom, it is named a *clear-story* window.

Transtra, (Lat.) the horizontal timbers in the roof of Roman buildings.

Trapezium, (Gr.) in geometry, a quadrilateral figure, whose four sides and angles are unequal, but two of its sides parallel.

Trapezoid, (Gr.) in geometry, an irregular figure that has all its four sides and angles unequal, and no sides parallel.

Traverse, a gallery or loft of communication, in a church or other large building.

Travertino, see *Peperino.*

Tread, the horizontal part of the step of a stair.

Treasury, a building for the reception of money or other precious things. Among the most ancient Grecian cities we find treasuries of a very singular form. See *Arch*, and *Grecian Architecture.* Buildings of the same kind have been discovered in Sardinia. The treasury of Minyas at Orchomenus is described by Pausanias. It was entirely of marble, and its form was that of a rotunda gradually terminating in a point. In ancient temples the back part of the building was generally used as a treasury. See *Opisthodomus.*

Trefoil, (Fr.) in Gothic architecture, an ornament consisting of three cusps in a circle.

Trellice, lattice work of metal or wood in screens or doors.

Trenches, in fortification, are ways hollowed in the earth in form of a fosse, having a parapet towards the place besieged, called lines of approach, or lines of attack; or a work raised with fascines, gabions, wool-packs, &c. to cover the men from the fire of the besieged.

Triangle, (Lat.) a plane rectilineal figure of three sides, and consequently three angles. If the length of any side of a triangle, and the length of a perpendicular to that side, drawn from the opposite angle, be known, these two lengths are called the *dimensions* of the triangle; or, if the lengths of the three sides be known, these three lengths are called the *dimensions* of the triangle. The *base* of a triangle is the side of which the lengths is known, or rather, the side on which the triangle stands, or which is opposite to the vertex. The perpendicular is said to be *given*, when its length is known. When the base and perpendicular are given, we may find the area of the triangle by multiplying them together, and taking half the product. As a triangle is the element of every rectilineal figure, and since the whole of every thing is equal to the sum of all its parts, the area of a rectilineal figure is equal to the sum of the areas of all the triangles; and it may easily be demonstrated, that the least number of triangles that a rectilineal figure can be divided into, is a number less by two than the number of the sides of the figure.

Trichoron, (Gr.) a building with three lodgings or stories.

Triclinium, the room in the Roman house where company was received, and seats placed for their accommodation. It was raised two steps from the peristyle, and was separated from the garden by a large window. Winter triclinia faced the west, and summer triclinia the east. They were sumptuously fitted up with paintings, gilt beams, and chandeliers. The Greek and Roman ladies sat in the triclinium, while the men reclined.

Triforium, (Lat.) the space between the aisles of a church and the clerestory, after containing a staircase.

The *triforia* were the three galleries or ranges of seats above each other. These galleries, or *triforia*, so frequently met with in cathedral and parish churches, were generally added to buildings of considerable antiquity, for the purpose of rendering them more lofty and commodious.

TRIGLYPH, (Gr.) an ornament of the Doric frieze, consisting of three parallel nicks, and supposed by some to represent the ends of beams. There is observed in the large hollow crown moulding of the temple of Dendera, a decoration very similar to the Doric triglyph, the extreme parts of which are placed at the angle as in Grecian Doric. In the Roman Doric the entablature is invariably placed over the centre of the column. In Greek examples, and in some Roman specimens, the triglyph is surmounted by the mutule, inclined; but in most modern profiles it is horizontal. On its soffit are represented *guttæ*, or drops. The spaces between the triglyphs on the frieze are called *metopes*, and, in modern examples, are made perfectly square, and generally enriched with sculptures. These sculptures are in modern works generally a bull's skull and a patera alternately. In ancient works they were generally historical or mythological designs. The extreme projection of all these ornaments should be less than the triglyph itself, so as to keep a due subordination between mere decorations and essential parts.

TRIGON, another name for a triangle.

TRIGONOMETRY, (Gr.) the science which teaches the mensuration of triangles.

TRILATERAL, (Lat.) having three sides.

TRIMMERS, pieces of timber framed at right angles with the joints against the wall, for chimneys, and well-holes for stairs.

TRIMMED IN, a term applied to a piece of work fitted between two others previously executed. Trimmers of stairs, when brought forward to receive the rough strings are said to be *trimmed out*.

TRIMMER, a small beam, into which are framed the ends of several joists. The two joists into which each end of the trimmer is framed are called *trimming joists*.

TRINGLE, a small member fixed exactly upon every triglyph, under the plat-band of the architrave, from whence hang the guttæ in the Doric order, called also a riglet or listel.

TRIREME, (Lat.) in ancient naval architecture, a galley with three banks of oars on each side.

TRIUMPHAL ARCH. The Romans were the first people who erected triumphal arches, and the earliest specimens are destitute of any magnificence. For a long time they consisted merely of a plain arch, with the statue of the victor and his trophies at the top. Afterwards the span of the arch was enlarged, and the style enriched, and the whole loaded with a profusion of all kinds of ornaments. The whole mass generally formed a square, which was penetrated by three arcades, and crowned by a very high attic, which was frequently covered with inscriptions and bas-reliefs, and supported equestrian statues, triumphal cars, and other ornaments of the same description. The archivaults were adorned with figures of Victory holding palms and crowns. The triumphal arches which still remain, may be arranged into three classes. The first class will embrace such as consist of a single arch, as that of Titus at Rome, that of Trajan at Ancona, &c. In the second may be classed those which are formed of two arches or arcades, as those of Verona, &c. which appear to have formed at the same time gates for the town. In the third class may be placed all those which are composed of three arcades, that in the centre being the principal or grand arch, and those at the sides much smaller; such is the arch of Septimius Severus, that of Constantine, &c. The lesser arch of Septimius Severus, called also that of the *Orfevres*, is of a class differing from either of these; it is not vaulted, but formed in plat-band.

The arch which is known to us as the arch of Constantine, appears, with much greater probability, to be the arch which was erected by order of the senate in honour of Trajan, and the greater part of the bassi relievi upon it represent the victories of that emperor. It is the best preserved of all the ancient arches, owing in part to the care bestowed upon it by pope Clement XII. It is at present buried to the height of the pedestals of the columns.

The arch of Septimius Severus, at the foot of the capital, which is also partly buried, bears a great resemblance to that of Constantine.

The arch of Titus, which is composed of a single arcade, is the first on which we find the Composite order employed. From the apotheosis of the emperor, which is represented in the centre of the vault, it appears to have been erected after his death.

A small arch on the Flaminian way, called *Arcus Portugalliæ*, and apparently constructed out of the ruins of some other edifices, was pulled down by order of pope Alexander VII., and its sculpture deposited in the capital.

The arch at Benevento, which is of the Composite order, was erected in honour of Trajan. The bassi relievi, which are exceedingly grand and bold, and are similar in point of taste to those of the arch of Constantine at Rome, represent different actions in the life of the emperor Trajan.

The arch of Trajan at Ancona, one of the most elegant works of ancient architecture, stands on the pier of the port, at the entrance of the mole, and is decorated with four Corinthian columns on pedestals. It is in excellent preservation, and is almost unequalled in the beauty of its construction, the elegance of its proportions, and its great simplicity.

The arch of Rimini is the most ancient arch now in existence, and, for its size, one of the noblest. It was erected in honour of Augustus, on the occasion of his repairing the Flaminian way from this town to Rome.

The arch at Pola, in Istria, on account of the beauty of its architecture and ornaments, is regarded as a monument of the Augustan age.

There are abundance of representations of triumphal arches to be seen on ancient medals.—For further information the reader may consult Bellori's work, and that of Suares on the arch of Septimius Severus; the arch of Benevento, published at Rome in 1739 and 1770; and that of Titus, published at Paris in 1770.

Trochilus, moulding, the same as the *Scotia*.

Trochoid, (Gr. *τροχος*, *a wheel*, *ειδος*, *shape*,) a figure which is described by a circle that rolls in a straight line, with a pointer pin in the circumference, on a fixed plane, parallel to or in the plane of the moving circle.

Trophonius, see *Agamedes*.

Trough-Gutter, a gutter below the dripping eaves, to convey the water to the pipe by which it is discharged.

Truncated, cut short. *Truncated Roofs*, are common roofs, flat at the top.

Trugg, a tray to carry mortar in.

Truncus, a term formerly applied to part of the pedestal of a pillar.

Truss; when the girders are very long, or the weight the floors are destined to support is very considerable, they are *trussed*: that is, for a simple beam is substituted a frame so constructed that the pressure is thrown more upon the walls, and the possibility of the beam being broken is prevented. This frame is termed a *truss*. See *Carpentry*, *Collar Beam*, and *Constructive Carpentry*.

Truss Partition, a partition formed by a truss.

Trussels, or *tressels*, (Fr.) supporting props, consisting of three or four legs, attached to a horizontal part.

Trussing-pieces, in a roof, are the timbers which are in a state of compression.

Try, to plane any thing by the rule and square only.

Tuf, (Fr.) a kind of sandy calcarious stone, porous, light, soft, without being fragile, ductile, and well calculated for the construction of vaults. Its colour and consistence varies according to the predominance of its several component parts. The travertino used in the construction of the cupola of St. Peter's, at Rome, appears to belong to this genus. The ancients give it the name of *porus*, (see *Porus*.) The celebrated temple of Apollo at Delphi was built of it, as was also the walls of the temple of Jupiter at Olympia, as well as the northern part of the temple of Juno at Altis.

Tuileries, a grand palace at Paris, commenced, in 1564, by Catherine de Médicis. It was built after the designs of Philibert de Lorme, and was finished in the reign of Henry IV. Some additions and alterations were made to it by Louis XIV. The façade consists of five pavilions, and four corps de logis, in a line which exceeds 168 toises in length. This palace, as Philibert de Lorme had designed it, was composed only of the pavilion in the middle, the two galleries where are the walks, and the two pavilions which join them. The two great masses of building, ornamented with great pilasters, and the two large pavilions at the extremities are additions, which have made the façade of the building much more extensive, but have injured the harmony of the ordonnance. The palace of the Tuileries is joined to the Louvre by a long and wide gallery, which extends along the bank of the Seine.

Tumbled in, the same as *Trimmed in*.

Tumulus, (Lat.) a small conical hill of earth, raised as a memorial over the remains of the dead, by the early nations of antiquity. In the Troad, and along the shores of the Hellespont, many of these *tumuli* are found, for a description of which, among other works, the reader may consult that of M. Lechevalier, sur la Troade. Even at the time of the Trojan war, many of these tumuli were in existence, and were then regarded as monuments of great antiquity. Such was the tomb of Æsyetes. Sometimes these tumuli were surrounded with stones, as was the tomb of Œnomaüs, near Elis, and that of Æpytus, on mount Sepia, in Arcadia, in the spot where he had been killed by a serpent. The Celts raised similar mounds of earth, which still exist in many parts of ancient Gaul and Britain. See *Sepulchral Monuments*, *Tomb*, *Druidical Monuments*, *Stonehenge*.

Tunnel, (*tonnelle*, Fr.) a subterranean canal, for carrying a stream of water under a road or hill.

Turkish Architecture. The architecture of the Turkish empire in general bears a great assimilation to that of the Arabs or Saracens. (See *Arabian Architecture.*) The public buildings are generally adorned with a great number of towers and minarets. The dwellings of the rich are surrounded by a court-yard, and in the interior is generally a magnificent hall, paved with marble, and containing fountains of water. This hall occupies the whole height of the building, and is most commonly surmounted by a dome. In the construction of private houses, little art or regularity is employed. See *Constantinople*.

Turning-piece, a board for turning a thin brick arch upon.

Turret, a small tower, often crowning the angle of a wall, &c.

Tuscan Order. The Tuscan order is not found in any ancient buildings; and the obscure description given by Vitruvius has left a wide field for the ingenuity of modern architects. Palladio composed two profiles; one from the description of the ancient master, and the other according to his own idea of an amplification of the Doric. The design of Vignola has been most generally approved and adopted. The base consists of a simple torus, with its fillet, accompanied by a plinth. The proportions, according to Sir W. Chambers, are—

	MODULES.		MINUTES.
The column	14	..	0
The entablature of the former	3	..	15
The base	1	..	0
The shaft (including the astragal that divides it from the capital)	12	..	0
The capital of the entablature......	1	..	0
The architrave (including the fillet)	0	..	31½
The frieze........	0	..	31½
The cornice	0	..	42

This order admits of no ornaments, and the columns are never fluted. Some architects represent rustic cinctures on the shaft, but this does not show good taste. See *Capital*, *Order*.

Tusk, (Sax.) a bevel shoulder, made above a tenon, to strengthen it.

Tympan of an Arch, a triangular tube placed in its corners, usually hollowed, and sometimes ornamented with foliage, &c.

Tympanum. (Gr.) the two sides of the roof, rising to an obtuse angle, form, above the principal façade, a triangle, called the *pediment*, and, by the French, the *fronton*. The Romans termed it *fastigium*, and the Greeks gave it the name of *aëtos* or *aëtoma*, (see *Eagle.*) It was sometimes named, from its form, *trichorium*. Beger in his Spicilegium, Winckelmann in his Essay on Architecture, and Visconti in Il Museo Pio Clementino, have given us some learned remarks on the origin of its Greek name *aëtos*, (the eagle.) It appears from Pindar that the custom of adorning the obtuse angle of the roof with an eagle was taken from the Corinthians, and that the name *aëtos*, given first to this angle, and afterwards to the tympanum of the pediment, was derived from this usage. It has been supposed that the Corinthians took the idea from the hawk with its wings expanded, which is often seen on the pediment of Egyptian buildings. Winckelmann thinks that this eagle was first placed on the pediment of temples, because the oldest temples were dedicated to Jupiter. Shaw found an eagle on the pediment of a temple near Tunis, and it is observed in a similar situation on ancient medals of Tarsus in Cilicia, of Pergamus, and of other cities. The pediment was one of the principal ornaments of the temple, and that by which it was particularly distinguished. Other public edifices were rarely decorated in this manner, and private dwellings had scarcely ever a pediment. Cæsar was the first who was permitted to adorn his house with a pediment, and it was then looked on as a divine honour; but afterwards the palaces of the emperors and of distinguished individuals were equally decorated. The triangular field of the pediment is termed the *tympanum*. According to Vitruvius, the height of the pediment in the middle should be the ninth part of the size of the cornice of the entablature at the façade of the temple, and it was covered with a cornice like that of the entablature. The *tympana* or pediments of the Grecian temples, of which remains have been preserved, do not agree entirely with these rules of Vitruvius, if the designs and measures of the artists who have made us acquainted with them are to be relied upon; as some of them are observed to be a little more, and some less, elevated; but, perhaps, in early times more elevation was given to the pediment than in succeeding ages, or even, although certain rules had been fixed, they were not so strictly adhered to, but the elevation might sometimes be regulated by the size and proportions of the entire temple. On the cornice at the summit, and at the two extremities, were often placed statues, vases, &c. supported on pedestals, called *acroteria*, (see *Acroterium*.) The pediments of the Etruscan and Roman temples were also surmounted by statues In the most ancient times the field of the tympanum was without ornament, as in the temple of Concord at Agrigentum, the temple at Ægestum, and even in that of Theseus at Athens. But the grander temples had generally bas reliefs on the pediment, representing some remarkable incident relating to the divinity to whom it was consecrated, or to the nation or city by whom it was erected. Windows and doors are sometimes surmounted by pediments, but this usage, which originated from a bad taste for ornament, is not to be recommended, particularly in a façade where the windows are crowded, as so many pediments have a bad effect, from the great number of pointed angles that crowd on the sight. This effect is still more disagreeable when the stories of windows are separated by cornices; for the summits of the pediments, approaching too near the cornices, form new angles by their contact with the separating cornice. A pediment is termed *broken*, when its rising cornices do not join; a *double pediment* encloses a smaller one within its *tympanum*. On ancient pediments may be consulted, Slieglitz, Archæologie des Baukunst; on pediments in general, the Cours d'Architecture of Blondel. See *Tympanum*, *Ætoma*, *Eagle*, *Pediment*. The term *tympanum* is also applied to the die of a pedestal, or the panel of a door.

TYPE, the canopy over a pulpit.

U.

Ulam, (Heb.) a building, supposed to be a large gate, facing the grand façade of the Jewish temple. See *Hebrew Architecture*.

Under-pinning, bringing a wall up to the ground-sill.

Ungula, the part of a cylinder, or cone, comprised by part of the curved surface; the segment of a circle, and a plane.

Unity. When an architect is charged with the construction of an edifice, he should first obtain a clear and definite knowledge of its nature and destination. By this means he will be enabled to invent and arrange the different parts, so that the tout-ensemble shall display a building exactly applicable to the purposes for which it is designed. This precision of character and design cannot, perhaps, at all times be attained; in such a case, it will depend chiefly on the taste and experience of the artist, to supply the deficiency; but, at all events, whatever plan he may determine to adopt, that plan must be kept constantly in view, or the result, instead of being beautiful and harmonious, will turn out to be unsightly and incongruous.

University, (Lat.) a collection of buildings for the education of youth; such as have studied there being admitted to certain degrees in different faculties. Universities in general comprehend several colleges, but this is not always the case. The university of St. Andrew's existed long before either of its colleges were founded.

Uphers, fir poles used in scaffolding, four to seven inches in diameter, and twenty to forty long.

Urn, (Lat.) a kind of round vase, destined, among the ancients, to receive and preserve the ashes of the dead. The Romans often made use of Grecian vases, as is evident from those that have been found in tombs in the vicinity of Naples. The Egyptians frequently enclosed their sacred birds, after being embalmed, in urns, which were covered with hieroglyphics. See *Vase*.

V.

Vagina, (Lat.) the lower part of a terminus, in which the statue is apparently inserted.

Valley, the internal angle of two sides of a roof. The rafter which supports the valley is called the *valley rafter*, or *valley piece*, and the board fixed upon it, for the leaden gutter to lie upon, is termed the *valley board*. Valley rafters are named, in old books, *sleepers*.

Vallum, (Latin,) a bulwark. There were several of these walls raised by the Romans in the northern part of our island. The *vallum Adriani*, which stretched along the whole breadth of the island from the river Tyne to the Solway-frith, was flanked by towers at regular distances, and was erected for the purpose of restraining the incursions of the northern barbarians: this is called the *Picts' wall*. The *vallum Agricolæ*, was also erected towards the north of Britain, as a restraint upon the Scots, by Julius Agricola, in the reign of Vespasian. The *vallum Antonini Pii*, had the same destination. The *vallum Severi* stretched from sea to sea, between the gulfs of Glotta and Bodotria, now the Clyde and the Forth. The *vallum Stiliconis*, was thrown up by Stilico, and reached from the mouth of the Derwent to that of the Elme. See *Adrian's Vallum, Severus's Wall,* and *Castra.*

VANE, *Fane*, or *Phane*, a plate of metal, shaped like a banner, fixed on the summit of a tower or steeple, to show the direction of the wind.

VARNISH. Varnishes may be divided into several classes—the first comprehending the most delicate varnishes, and those that are used in fine work: the second, the most drying varnishes that can be obtained with spirits of wine: the third, different species of changing varnishes, of a less drying nature, but nearly similar in other respects to the first: the fourth, varnishes formed with essential oils, and particularly oil of turpentine: the fifth, such as are formed by the employment of pure copal, treated with oil of turpentine, and even with ether: the sixth, varnishes made with copal, amber, and caoutchouc.

The varnishes of the first class consist of simple substances, as pure gum, isinglass, &c.

Of the second, or drying varnishes, made with spirits of wine, the following are the best:—Take

(1.)	Spirit of wine	32 oz.
	Purified mastich	6
	Gum sandarac	3
	Venice turpentine (very clear)	3
	Glass coarsely pounded	4

The mastic and sandarac must be finely pounded; the fine parts of the glass should be separated from it by means of a hair sieve. Put the spirits with the ingredients, which have been previously mixed together, into a short-necked matrass, with a stick of white wood to stir it, and place the matrass in a vessel filled with water, which must be kept in a state of ebullition for nearly two hours.

(2.)	Gum sandarac	8 oz.
	Pounded mastich	2
	Clear turpentine	2
	Pounded glass	4
	Spirits of wine	32

These two varnishes, as well as the following, give a very brilliant lustre; but the following has the most durability.

(3.)	Pounded copal of an amber colour, once liquefied	3 oz.
	Gum sandarac	6
	Mastich	3
	Clear turpentine	2½
	Pounded Glass	4
	Spirit of wine	32

Both these latter varnishes may be mixed in the same manner as No. 1.

The third kind of varnishes are less drying than the second kind, but have a much weaker smell.

(4.)	Gum sandarac	6 oz.
	Gum elemi	4
	Gum anima	1
	Camphor	0½
	Pounded Glass	4
	Spirit of wine	32

The camphor must be added in pieces.

(5.)	Seed lac	6 oz.	0 grs.
	Amber or copal (finely ground)	2	0
	Dragon's blood	0	40
	Extract of red sandal-wood, obtained by water	0	30
	Hay saffron	0	36
	Pounded glass	4	0
	Spirit of wine	40	0

This varnish will give a beautiful gold tint to articles of brass, which must be exposed to a gentle heat, and then dipped into it.

(6.)	Seed lac	5 oz.
	Gum sandarac	2
	Gum elemi	1½
	Venice turpentine	2
	Pounded glass	5
	Spirits of wine	24

This is used in France for varnishing boxes made of box-wood, roots of trees, &c.

(7.)	Frankincense	6 oz.
	Gum anima	2
	Gum elemi	2
	Pounded glass	4
	Spirit of wine	32

This is a good varnish for ceilings and wainscoting.

(8.)	Gum sandarac	6 oz.
	Shell lac	2
	Resin	4
	White glass pounded	4
	Clear turpentine	4
	Spirit of wine	32

These varnishes may generally be made according to the direction for No. 1.

(9.)	Gamboge	0¼oz.	grs.
	Gum sandarac	2	0
	Gum elemi	2	0
	Dragon's blood	1	0
	Seed lac	1	0
	Terra merita	0¼	0
	Hay saffron	0	12
	Pounded glass	3	0
	Spirits of wine	20	0

This is a good varnish for changing or modifying the colours of those bodies to which it is applied. The saffron and terra merita should be infused in the spirit for twenty-four hours.

(10.) *White Copal Varnish.*

Copal (melted)	16 oz.
Linseed oil (boiled)	8
Essence of Venice turpentine	16

The Venice turpentine must be put in after the others have been boiled, well mixed and stirred, and nearly cool.

Varnishes are polished with pumice stone and tripoli earth. The pumice stone must be reduced to an impalpable powder, and put upon a piece of serge moistened with water, and with this the varnished substance must be rubbed lightly and equally. The tripoli must also be reduced to a very fine powder, and used with a clean woollen cloth moistened with olive oil. Afterwards the varnished surface is wiped with soft linen, cleansed with Spanish white or starch, and rubbed with the palm of the hand, or with a linen cloth.

The *Chinese varnish* is a resinous substance, which exudes from a tree called in China *tsi-chu*, "varnish tree." When the tree has attained an age of about seven or eight years, when its trunk is nearly five inches in diameter, they make several rows of incisions round the trunk, the first row being seven inches from the earth, and the others about the same distance from one another. The liquor only distils during the night, and in the summer season. The incisions are made towards evening, and the next morning the varnish has collected in shells, which they insert in the incisions at the time they cut them. The following evening they are again inserted, and the operation is continued during the summer. A thousand trees yield in one night almost twenty pounds of varnish. While the varnish is extilling, it exhales a malignant vapour, against the bad effects of which it is necessary to use great precaution.

Vase, a name given to the bell, or naked form, of the Corinthian capital, on which the leaves are disposed.

Vase. The Grecian vases, which have been from time to time dug up in various parts of Italy and Greece, have long attracted attention, by the elegance of their form and decorations. Large collections have at various periods been made, and several collections of drawings from them have been published. Mr. Millingen's work (Peintures Antiques de Vases Grecs) contains an introduction, in which we find some positive ideas on the manufacture of the Greek vases.

During the last century and a half, collections of painted Greek vases have been formed: endeavours have been made to guess at the processes employed by the potters; but time alone has revealed them to us. It was necessary to possess a very great number, to discover among them some which showed vestiges of the first labour; and to have eyes sufficiently exercised, to be able to recognize and describe them: it is only within these few years that this could be done.

First, a clay was chosen, in which baking would produce the colour desired, red, black, or yellow. When this clay was not to be had, they introduced into that which they were forced to employ, ochres, (oxyds of iron,) to produce the colour. The vase thus formed was placed in the oven, where the first baking gave it so much consistency that the fluid colours would not sink in. From the hands of the potter these vases were transferred to those of the painter. The painter traced upon them, with a metal point, in dotted lines, the oval of the head and the parts of the limbs which were to be covered by the drapery: sometimes this sketch is done with a coloured line, but of a colour different from that of the ground: then he designed, round this oval and the other dotted lines, with the pencil, a broad black line. This sketch and first operation are still visible on two vases in the collection above mentioned, but they are generally hidden by the colours, which were laid on flat, without degradation. Those vases are considered as the most ancient which are of only one colour, that of the clay of which they are made. Soon after, they were painted black: hence comes the name of Λίβυες, which Hesychius gives to the vases placed in the tombs; and the poor retained the use of them, while the rich employed those which were adorned with figures. The most common vases are still sought after, on account of the beauty of the forms. ....

The vases adorned with painted figures are those which are the most highly valued. Antiquaries are agreed in considering as the most ancient, those of which the ground is yellow, (the colour of box,) and the animals painted on them, oftener than human figures, of a brick red. Mr. Dodwell found several in tombs near Corinth; the inscriptions painted upon some of them indicate the highest antiquity.

The vases of the second period have a yellow or white ground, and the figures are black; their inscriptions are for the most part not to be read; the drawing is incorrect; the figures want life and expression; the subjects represented are frequently inexplicable, because the vases are anterior to the fourth century, when Zeuxis created, and caused to be generally adopted, constant modes of painting the gods and heroes. It is believed that the second sort of vases is that which was most generally imitated in the following ages, from the love of Archaism.

The ground of the vases of the third sort is black; the figures are yellow or red: these are the most common.

Sometimes we find, on the Greek vases, blue, green, carmine, and even gilding. The white colour was added on the painting in the accessaries, as well as the inscriptions; hence it happens that they have often been in part rubbed off. The white colour was partly made of white-lead.

A second baking fixed the colours on the vases, and gave them that bright varnish which distinguishes the most precious of them As for ordinary vases, a varnish was given to the whole ground before the baking, which in this case was not followed by a second.

The figures were generally copies, and not original, of the invention of the painters of the vases. M. de Rossi thinks we may infer this from the circumstance, that no painting is found in which the artist has corrected himself, that is to say, where he has departed from the dotted lines, or even changed any attitude.

Very different judgments have been passed on the painters of the Greek vases of baked earth, or rather on the designers. If we examine the variety, the elegance of the draperies, the beauty of the figures, the exactness of the proportions, we shall own that these designers have some merit, especially when we consider that the figures drawn on the convexity of the vases, and in the concavity of the pateræ, are in true perspective, so that they may not appear deformed: this is so true, that if we trace the outline of one of these figures, and lay it on a plane surface, it will seem to lean backwards, to fall: (it is the art of the painter of ceilings.) On the other hand, the extremities of these beautiful figures (the hands and feet) are drawn with as much negligence as we find in the pictures of savage nations. The designers, or drawers, were therefore not painters, properly so called; they were indifferent copyists; and the paintings on the Greek vases are not originals, but copies of pictures, bas-reliefs, or statues, which had acquired celebrity.

How could these designers make a collection of studies of these fine works? What substances did they employ in lieu of our different kinds of pencils, of our transparent paper? &c. Is it probable that our mode of tracing was unknown to them, by which the most moderate artists trace faithful copies? what process did they use in its place? Perhaps they made sketches of the pictures which they intended to imitate, or of those which they had seen on their travels. Hence it comes, that in the paintings on vases, the principal parts are well executed, and the extremities are very incorrect. Having trusted the latter merely to their memory, they were incapable of drawing them faithfully.

The name of *Sicilian vases* is improperly given to those in which the figures are distinguished from the ground by their black or dark colour, (whereas in the others, the figures are yellow, on a dark ground,) and which are found in other places besides Sicily. This mode recals to mind the invention of painting, the imitation of the shadow on a wall: the style of design is barbarous and incorrect; hence many antiquaries have assigned them the highest antiquity. They would have been in the right, if they had said that this style, appearing to be appropriated to masquerades, caricatures, and the like, was probably imitated at all times in subjects of this kind. What evidently proves it is, that the manufacture of these vases, the elegance of their forms, are the same as in the vases of the finest style, the vases of Nola; the same must be said of the ornaments which accompany the figures, flowers, festoons, &c., which are the same, and equally elegant. However, what we most frequently see on the vases called *Sicilian*, are Bacchanalia; that is to say, masquerades, orgies, caricatures, for which this kind of painting was perfectly adapted; and was probably affected to be retained for these subjects, from a spirit of religion. The Athenian coins afford a similar instance of affectation of Archaism.

Since we have spoken of the festivals of Bacchus, we must speak also of the mysteries and initiations, because there has been established, since the time of Passeri and Montfauçon, an opinion, which ascribes all the painted vases to the initiated, whom they accompanied in the tombs. Mr. Millingen has successfully refuted this opinion. First, it is not founded on the authority of any ancient author. When we discover a collection of tombs, all containing vases more or less precious, will it be asserted that all the dead, whose remains are contained in these tombs, were initiated in the mysteries of Bacchus? What shall we say of those of children, who could not have been admitted to initiation, and which also contain vases?

For what reason were vases placed in, or near, the tombs? The Greeks burned or interred the dead indifferently, as is proved by the vases containing bones and ashes, placed in some tombs, which are surrounded by other tombs, in which the dead are laid upon leaves. The first tombs contain fragments of vases, which were broken when they were thrown upon the funeral pile; those fragments were gathered up with the ashes, and bear evident marks of the action of fire. The vases, improperly called *lachrymatories*, which are found in the tombs, and the urns of the Romans, have the same origin. Their arms were interred with warriors; the appendages of the toilet, with women; with both, the vases which had been valued, which had contained the wine, the oil, the milk, the perfumes used on the bodies, the central water which served for the purifications, the portion of the funeral repast which was consecrated to the dead, &c. Some placed these vases carefully in the tombs, others threw them in and broke them; hence the many fragments of vases, which the restorers artfully collect, filling up the vacancies with other pieces which they dexterously paint. This fraud may be detected by applying acids to the newly-painted parts.

It is not our design to retrace the history of the discovery of the painted Greek vases, either at Corinth in the time of Julius Cæsar, or in Etruria and Campania, on the revival of learning, because these details are to be found in numerous works; nor to repeat the explanations of the paintings and of the inscriptions which Lanzi has judiciously restored for the most part to the Greek fables. We cannot, however, pass over in silence the explanation given by M. Akerblad, of the frequently repeated inscription ΗΟΠΑΥΣ ΚΑΛΟΣ, which Mazzochi, Millin, &c. have read *the beautiful Hopaüs.* M. Akerblad reads ΠΟ ΠΑΙΣ ΚΑΛΟΣ (ὁ παῖς καλος) *the beautiful child.*

Amongst the finest collections of published Greek vases may be mentioned, the Picturæ Etruscorum in Vasculis, by Passeri, and the collections published by D'Hancarville, Tischbein, Millin, and M. Dubois de Maisonneuve. See *Campana*, *Echea*, *&c.*

Vatican, one of the hills on which the city of Rome is built; on which stands a celebrated palace that bears the same name; and at the foot of the hill is the cathedral of St. Peter. See *Peter's, St.*

Vault, (*voute*, Fr. *volto*, Ital.) an arched roof, so contrived, that the stones which form it sustain each other.

A *cylindric vault* has its surface part of that of a cylinder; a *vault in full centre* is formed of the surface of a semi-cylinder; when a vault formed by any curve is greater in height than half the span, it is said to be *surmounted*, when less, *surbased;* a *rampant arch* has its springings in a plane not parallel with the horizon; in a *double vault*, one vault stands above another; a *conic vault* is formed of part of the surface of a cone, as a *spherical vault* is of that of a sphere; the plane of an *annular vault* is contained between two concentric circles; a vault is *simple*, when it is formed by the surface of some regular solid, around one axis; and *compound*, when compounded of more than one surface of the same solid, or of two different solids; a *cylindro-cylindric vault* is formed of the surface of two unequal cylinders; and a *groined vault* is a compound vault rising to the same height in its surfaces as that of two equal cylinders, or a cylinder with a cylindroid.

Neither the Egyptians nor the Greeks made use of the arch or ceiling composed of stones, which, by acting against each other, are supported by the same force by which they would otherwise fall. Their ceilings were formed of stones of an extraordinary size, either bearing the whole length from one wall to another as lintels, or tailed down in the manner of the steps of a stone staircase. The architrave of the temple of Diana at Ephesus, the temple of Latona at Buttis, and the tomb of Osimandyas in Egypt, have been cited as extraordinary examples; the latter being covered with stones eight cubits long, the foot of the statue of this Osimandyas being seven cubits in length. The Egyptian cubit was about twenty-two English inches. See *Arch*.

In a paper by Captain Mackintosh, in the fourteenth volume of the Asiatic Researches, is described the following curious method of building semicircular arches, as practised by the Indians at Nagpore. "The arch was semicircular, + 22 feet span; the piers were built in the usual manner, and very substantially. At the spring of the arch, stones of a considerable length were used, having the inner end cut, so as to suit the curvature of the arch. Six such layers were laid on each side, in the manner stones are placed in what is generally termed the *Egyptian* arch; the upper layer having a groove, five inches wide, and two in depth. On arriving at this height, stones of a smaller size were made use of, each having a groove cut in two adjoining faces, two inches in depth by four in breadth, with corresponding projections on the opposite sides. These stones were so placed, that when a layer was completed, there appeared a channel or groove the whole length of the building, ready to receive and bind to it, by their projections, the next row of stones, when applied. The stones were of a fine sort of free-stone, easily cut. Common cement was used. Eight layers of the stones last described having been placed on both sides, each layer occupying about six inches of the curvature of the arch, it becomes necessary to prevent the work, if carried on, from falling inwards. A space of ten feet in length, on each side of the unfinished arch, was marked off, and at these points two strong horizontal beams were forced into the grooves, extending across the chasm. From these, as from a new base, the grooved stones already described were used; the length of each succeeding layer contracting gradually, until the application of the key-stones. When the arch is of considerable span, a series of bases, such as now described, is placed, each base higher than the other, in order to support the work until it is secured by being keyed. When the centre portion of the arch has been thus completed, the beams are removed by being sawed asunder in two places. In a similar manner the arch was continued in different portions at either end of that part first finished. In this simple though ingenious manner was an arch, across a span of twenty-two feet, erected, without any frame for its support while building." See *Phials*, and *Solids*, *Architectural*.

Velarii. In the interior of the ancient houses, there were no doors to close up the openings between one room and another, but instead of this was suspended before each a curtain or veil, and the slaves who had the care of this curtain, and whose business it was to watch near it, were named *velarii*. Under the emperors, the place of *velarius domus augustæ* was an important charge. Details on this subject may be found in Pignorius, de Servis; Sagittarius, de Januis Veterum; and the observations of Lipsius on the fifth chapter of the third book of the Annals of Tacitus.

Velarium, the great curtain, anciently spread over theatres or amphitheatres, to give shade to the spectators. See *Amphitheatre*.

Vellar Cupola, a term applied, by Alberti, to a dome, or spherical surface, which is terminated by four or more walls.

Veneer, a thin piece of a more valuable kind of wood, for covering furniture, &c. which is made of a more common kind. The wood intended for veneering, or inlaying with veneers, is first sawed out into slices or leaves about a line thick; in order to saw them, the blocks or planks are placed upright in a kind of vice or sawing press; they are afterwards cut into slips, and fashioned according to the design proposed. When the joints have been carefully adjusted, and the pieces brought down to their proper thickness with several planes constructed for the purpose, they are glued down on a ground or block of dried wood, with strong English glue. When the pieces have been thus joined and glued, if small, the work is placed in a press; if, on the contrary, it be large, it is laid on a bench, covered with a board, and pressed down with poles or pieces of wood, of which one end reaches to the ceiling of the room, and the other bears on the boards. When the glue is quite dry, it is taken out of the press to be finished. First it is smoothed with small planes, then with divers scrapers, some resembling rasps, &c. When sufficiently smoothed, the work is finished, by polishing it with the skin of a sea-dog, wax, and a brush and polisher of shaved glass.

Venetian Blind, see *Blind*.

Venetian Door, a door which is lighted on each side.

Venetian Window, a window in three separate apertures.

Vent, the flue or funnel of a chimney.

Ventiducts, (Lat.) subterranean passages for the preservation of fresh or cool air.

Ventilation. A certain current of air is absolutely necessary in every room which has a fire, for the purpose of carrying the smoke up the chimney. Smoky chimneys, in new houses more particularly, are frequently caused by the closeness of the room. The obvious remedy is to admit more air, and the question will be, how and where it is to be admitted, without destroying the comfort of its inhabitants. Various methods have been tried to obviate this inconvenience by letting in the air from without through the jambs, or into the flue of the chimney, but they have all been found unsuccessful, and many of them have produced an effect contrary to that which was intended. The air that is thus required, must, therefore, be admitted into the room, and it is advisable to make the aperture for its admission as near as possible to the ceiling. Chimneys, which at other times draw well, are not unfrequently caused to smoke by the improper situation of a door. When the chimney and door are placed on the same side of the room, if the door is made to open from the chimney, it follows that, when only partly opened, a current of air is admitted, which, being directed across the opening of the chimney, is apt to draw out some of the smoke. Other causes frequently render chimneys smoky—such as, short flues, which can only be remedied by contracting the opening at the bottom; a situation near some other building, wall, &c. which is higher than the top of the chimney, when the only remedy is to place a cap on the top of the chimney, or to raise the chimney higher than the buildings, &c. which are near it.

Vermiculated, stones, &c. worked so as to have the appearance of having been eaten by worms.

Vertical, opposite.

Vestibule, (*vestibulum*, Lat.) the place before the entrance to the Roman houses, which was surrounded by a wall. It was here that the clients of the master of the house, or those who wished to pay their court to him, waited to be introduced. As the vestibule was without the house, it was not considered as forming a part of it. The entrance from the vestibule led immediately into the *atrium*, or into the *cavædium*. In country houses, they first entered the peristyle. See *House*. Some have derived the name from *Vesta*, whose altar is said to have been placed in this area.

Vestry, (*vestiarium*, Lat. a wardrobe,) a room adjoining the church, where the vestments of the minister are kept, and parish meetings generally held.

Vice, (Fr. *vis*, a winding or spiral staircase, a term found in old records.

Vidimus, a pattern or design for a painted glass window.

Vigna, a name given by some to the villas of the modern Italians. See *Villa*.

Vignola. James Barozzi, or Baroggio, called from the place of his birth, Vignola, was born in 1507, his father being a person of consequence, who had been obliged to retire from his country on account of the political strife of the time. He was educated at Bologna, where he acquired an early reputation for the correctness of his architectural designs, which he drew on the principles of Vitruvius. From Bologna he went to Rome, where he was admitted into the newly founded academy of design, and afterwards became acquainted with the abbé Francisco Primaticcio, whom he accompanied to France, where he was employed in drawing plans for several eminent buildings. On his return to Bologna, two years after, he was employed in forming a plan for the façade of the church of St. Petronius; he also built several palaces there, as well as the canal of Naviglio, running to Ferrara.

Among his other works were the palace of the duke of Parma at Placentia, and several churches at Rome; where he returned in 1550. Through the interest of Vasari, he was appointed architect to pope Julius III., by whom he was employed on a villa and church, and in conducting the aqua vergine to Rome. He afterwards built the castle of Caprarola, and the greater part of the church of the Jesuits at Rome. On the death of Michael Angelo, he succeeded him as architect of St. Peter's, in conjunction with a Neapolitan, named Piero Ligorio. He was commissioned by Gregory XIII. to settle the limits between the territories of the Church, and those of the duke of Tuscany, and died on his return in 1573, at the age of 66. His treatise on architecture has been long esteemed, and his work on perspective has passed through many editions.

Villa, (Lat.) a country house, for the retreat of the rich. In the construction of their country houses, the Greeks were careful to select a situation which should be warm in winter, and shady in summer. The apartments of the women, here, as well as in the town houses, were separated by halls and baths from those of the men. In the age of Aristides and Pericles, the country houses were very simple. They were embellished in a richer style, as the Greeks gave themselves more and more to luxury, and particularly in the time of Alexander, when they gave to them all the magnificence possible. But in the embellishment of their country houses, the Greeks were far surpassed by the Romans, who lavished on their *villæ* all that riches and prodigality could procure for the enjoyment of life.

At the period when the Romans lived in simplicity, and when they were unacquainted with luxury, their country houses differed little from their town houses; they contained neither paintings, statues, or even any kind of ornament. The villæ of Marcus Cato were so rustic, that the walls were not even plastered. The *villa publica*, near the Campus Martius, was constructed with nearly the same rudeness, as was also, according to Seneca, (in his eighty-sixth epistle,) the villa of Scipio Africanus. When the Romans had amassed riches by their conquests in Asia, in Greece, and in Sicily, and had learnt the luxuries of those countries, they began to enlarge and adorn their villæ. In a short time they became quite the contrary of the ancients: before, they had only what was useful; now, they thought only of what was agreeable. "Our ancestors," says Varro in the thirteenth chapter of the first book of his work, De Re Rustica, "gave to their villæ an extent proportionate to the quantity of fruit, and the productions of the earth; now, we see nothing but profusion: they gave more extent to the buildings which were designed for purposes of economy than to their habitations; now, we do just the contrary. Formerly they praised a villa when it had a good kitchen, large stables, and extensive magazines for the preservation of oil and wine; now, the villæ of Metellus and of Lucullus far surpass the public buildings of the capital. The only care of these men is to give coolness to their summer dining-rooms, and to expose to the sun those apartments which are destined for winter habitation; instead of which, our ancestors thought more of the situation most convenient for the places destined for the preservation of wine and oil."

In the choice of situation and aspect, the Romans were very particular, especially in the latter, as, glass for windows being then little known, and the substitutes for it costly, and not in general use, the buildings and rooms could only be rendered conveniently habitable in bad weather, by a careful attention to their aspect.

Vitruvius has left us the following rules for the arrangement of the different parts of a villa. The winter triclinium and bath should look to the declining sun, because the afternoon's light is sometimes required, and the sun, when in the west, shining upon them, makes this aspect warm and pleasant in the evening. Bed-chambers and libraries should look to the east, for in these the morning light is required; and in libraries that look to the south and west, the books are liable to damage from the damps that are generated by the winds from that quarter. The spring and autumn triclinia should look to the east, for the windows being then turned from the sun, when it is proceeding westward, render their apartments temperate at the time when they are generally used. The summer triclinium should look to the north, because this aspect is not, like the others, very hot at the summer solstice. The *pinacothecæ*, or picture rooms, as well as the embroidering and painting rooms, should also have a northerly aspect, that the colours used in the works, on account of the equality of the light, may remain unchanged.

In the situation of their villæ, the rich Romans were careful to select a fertile and salubrious country, to have a good, and at the same time a picturesque and agreeable road, a good neighbourhood, and a sufficient quantity of good water. A good road, says Columella, induces the proprietor frequently to visit the country, and at the same time facilitates the conveyance of such things as are necessary to agriculture, &c. Pliny speaks highly in praise of the beautiful road that conducted to his villa Laurentinum. It was also considered as a great advantage to a villa to have a navigable river near it, not only because it frequently added much to the beauty of the scenery, but also for the convenience of carriage. The country most admired for the situation of the villæ of the Romans, was Campania, and more particularly the neighbourhood of Baiæ, where there were a great number of elegant country residences. Some districts of Latium were not less beautiful, and the rich Romans resorted to the environs of Tusculum and of Tibur.

The Romans had three kinds of *villæ*, each having its particular destination, or rather each villa had three parts—these were the *villa urbana*, the *villa rustica*, and the *villa fructuaria*. The *villa urbana* contained the habitation of the proprietor, and in it were found all the conveniences of a mansion in the city. Vitruvius gives this villa the name of *pseudo-urbana;* Palladio, Suetonius, and other authors, name it *prætorium.* The *villa rustica* contained not only all that pertained to rural economy, the barns, and the stables, and the places to keep the agricultural instruments, but also the kitchen, and the dwelling of the steward, and the other persons who were employed under him. The *villa fructuaria*, was appropriated to the preservation of the different productions of the estate, and it contained the granaries for corn, magazines for the oil, and cellars for wine, &c.

The *villa urbana* was generally placed in a situation somewhat more elevated than the other two. It in general had the same distribution as the city habitations of the Romans, and only differed from them in this, that in the latter we entered first the atrium, beyond which was the peristyle; and in the villæ, on the contrary, the peristyle was nearest the entrance, and beyond it was a court, surrounded by porticos, which, like the peristyle, served for a promenade; it was ornamented with care, paved with slabs of marble, and its walls and roofs elegantly adorned; the columns were either of marble, or of marble stucco. Facing the entrance to the court was a large dining hall, whose aspect was such as to command the finest view. Besides this large dining-hall, each villa had others smaller, situated on the sides of the edifice, in that part which would afford the best prospect. On one side of the court were the bed-chambers, the sitting-rooms, and the library; on the other the baths, and the rooms for the slaves and the domestics. The interior distribution of the villa differed according to circumstances, according to the situation, and according to the wants or caprices of the proprietor. Sometimes they contained large picture galleries, as in the villa of Lucullus. Many had long vaulted galleries, separated from the dwelling-house, and generally running towards the garden; these served as promenades: there were such galleries in Pliny's villas, Laurentinum and Tusci. These were sometimes termed *cryptoportici*. Care was always taken to give to each chamber the aspect which agreed best with its destination. Hence the villa in many cases had summer apartments, and winter apartments.

In the *villa rustica*, nearest the entrance, were contained the apartments of the steward, &c. By the side of these was a chamber, in which were deposited the ploughs, and other agricultural implements. Near this, towards the south, were the rooms for the slaves. The prison for refractory slaves was partly beneath the ground. Columella mentions also an infirmary for the slaves who were sick. The kitchen was by the side of the court, and served not only for cooking, but also for a place of retreat for the various servants, &c. who rested there after their labour, and took their meals in it. The rest of the villa rustica was occupied chiefly by stables, and places for the cattle, sheep, fowls, pigeons, &c. In the middle of the court, which was termed *cohors*, was a reservoir filled with water, which was resorted to by the geese, ducks, and other aquatic fowls.

See the articles *Granary*, *House*, &c. for further information relating to the distribution of the several kinds of villæ. — The following description given by Pliny of his villa at Laurentum, will convey a tolerable idea of the extent, accommodation, and grandeur of the Roman villæ, although this was considered as on a small scale.

After he has described the route, the views on the road, &c. he adds, "My villa is large enough to afford a convenient, though not sumptuous reception for my friends. The part which first presents itself is the *atrium*, plain, but not mean; then the *portico*, in form of the letter O, which surrounds a small but pleasant area; this is an excellent retreat in bad weather, being sheltered by glazed windows, but more by the projection of the roof. Beyond the portico is a pleasant cavædium, beyond which is a handsome triclinium, which advances upon the shore, so that it is gently washed by the waves when the south-west wind blows. On every side are folding-doors, or windows, as large, so that, from the sides and the front, you enjoy a prospect, as it were, of three seas, and backwards are seen the cavædium, the portico, and the area; again, the portico and the atrium, terminated by woods and distant mountains. On the left of the triclinium, but not so forward, is a large *cubiculum*, and then a smaller one, where one window admits the rising, and another the setting sun. From hence you view the sea, rather more distant, but more securely. The cubiculum and triclinium, by their projecture, form an angle, which not only retains, but augments, the heat of the sun's rays. Here then is my *hybernaculum*, (winter-apartments,) and the gymnasium for my family, which is never incommoded by any winds, but such as bring cloudy weather, and destroy the otherwise serene situation of the place. Adjoining to this angle is a *cubiculum* of a curved form, the windows of which admit the sun through its whole course. In the walls are inserted library presses, furnished with books more for amusement than study. Close to this is the *dormitorium*, (sleeping-room,) separated by a space having a covering of wood-work, which collects and distributes the vapour to the room in salubrious temperament. The remainder of this wing is allotted to my servants and slaves; yet it is sufficiently neat for visitors.

"On the right side of the triclinium is a most elegant *cubiculum*, with another large *cubiculum*, or moderate *cœnatio*, which receives light both from the sun and the sea. Beyond this is another *cubiculum*, with a *procœton*, for height a summer, but for shelter a winter apartment, being screened from all winds; a wall only separates another *cubiculum* with its *procœton*. Next you enter the spacious and extensive *cella frigidaria* of the bath; against the walls of which are two projecting *baptisteria*, sufficiently large to swim in; adjoining to this are the *unctuarium*, the *hypocaustum*, and *propnigeum* of the baths; and two other cells, more elegant than sumptuous. Adjoining is a skilfully contrived *callida piscina*, (warm-bath,) where those who swim enjoy a view of the sea; not far distant is the *sphæristerium*, (tennis court,) which enjoys the warmest rays of the declining sun. Here arises a *turris*, (pavilion or summer-house,) under which are two *diætæ*, and two also above, besides a *cœnatio*, from which is a beautiful prospect of the sea, the distant coast, and several pleasant villas; there is also another *turris*, containing a *cubiculum*, exposed to the rising and the setting sun; beneath this are the *apotheca* and *horreum*, (cabinet and store-room,) and underneath a *triclinium*, where the noise of the sea is not heard, except in storms, and then but faintly. This looks on the *gestatio*, (riding-course,) and the garden which it surrounds. The *gestatio* is encompassed with box, or rosemary where the box is wanting; for box, when well sheltered, flourishes much, but withers, if exposed to the wind or weather, or to the sprays of the sea. To the inner circle of the *gestatio* is joined a shady row of young vines, with a soft and pleasant walk. The prospect here, not less pleasant than that from the sea, is enjoyed from a *cœnatio;* on the back it is encompassed by two *diætæ*, whose windows look to the vestibule of the villa, and to a fruitful kitchen-garden. From this place extends a *crypto-porticus*, which may be compared for size to a public building having windows on both sides, those next the sea the most numerous. When the day is serene and calm, these windows are all opened; but when the wind is troublesome on one side, those on the other side are opened without any inconvenience. Before the *crypto-porticus* is a *xystus*, fragrant with violets, in which the warmth of the sun is increased by its reflection from the *crypto-porticus*, which at the same time shelters it from the north-east wind; wherefore it is hot in the front, and cool in the rear: it is also screened from the south-west and several other winds. All these render it pleasant in winter; but it is much more so in summer: for before mid-day, the *xystus*, and afterwards the *gestatio* and part of the garden, are made temperate by the shadow of the crypto-porticus, which is larger as the day proceeds.

"At the top of the *xystus*, projecting from the *crypto-porticus*, are the *diætæ* of the garden, and these are my delight; for here, in truth, I have placed my affection. Here is an *helio-caminus*, one side of which looks to the *xystus*, the other to the sea, and both to the sun. From the folding-doors is seen the *cubiculum*; from the windows the *crypto-porticus*: on the side next the sea, and opposite the wall, recedes a very elegant *zotheca*, to which a *cubiculum* is added by means of glazed windows and curtains. In this room are contained two chairs and a bed, from the foot of which you have a prospect of the sea; from the back of the neighbouring villas; and from the head of the woods—each window giving a different prospect. Adjoining is a *cubiculum* for night and sleep; for here neither the noise of servants, the murmur of the sea, the roaring of tempests, the glare of lightning, nor even the light of day, is perceived, till the windows are opened; but all is profound silence, which is caused and preserved by an *andron*, (open court,) which is between the wall of the *cubiculum* and that of the garden; so that all noise is drowned by the void space between. Close to this cubiculum is a small *hypocaustum*, the heat from which, by a small window, may be regulated at pleasure. Hence extend a *procœtum* and *cubiculum*, which enjoy the sun, though obliquely, from sunrise till after mid-day. When retired to these apartments, I seem as though absent from my villa: I feel great pleasure here, particularly in the time of the Saturnalia, when the other parts of the villa, by reason of the freedom allowed at that time, resound with festive clamours; for here I neither obstruct the diversions of my servants, nor they my study."

Pliny describes seven others of his villæ in different parts of his epistles; that at Tuscum was much more spacious than the one now described. He mentions several on the border of the lake Larium, now lake Como, in the Milanese. The larger villas of the Romans had attached to them parks, menageries, fisheries, rabbit-warrens, and sometimes even circuses and theatres. The celebrated villa of Adrian has been already described under the article *Adrian's Villa*.

The rage for building splendid villas was carried by the Romans into the different countries they conquered, particularly into Gaul and Britain. Many remains of Roman villas have been found in different parts of these countries

One of the most extensive Roman villas that have been discovered in Great Britain, is that at Bignor, in Sussex, which is described by Mr. Lysons, in the eighteenth and nineteenth volumes of the Archæologia. The first discovery of this villa occured in 1811. A farmer who occupied the land, in removing the earth, discovered a fine mosaic pavement, in the room marked in our plan, (pl. *Balusters*,) 7. In the centre of this apartment was an hexagonal *piscina*, or cistern, formed of a hard white sort of stone, four feet in diameter, and one foot seven inches and three-quarters in depth, with a border of stone round it, nine inches and a quarter wide, and a step within it, at nearly half its depth, five inches and a half wide; at the bottom is a round hole three inches in diameter, from which a leaden pipe for carrying off the water was afterwards discovered on the outside of the south wall, running in a southern direction. The room appeared to have been heated by an hypocaust; and, in clearing away the earth, part of a small Doric column was found. The next room discovered was that marked 26; the walls of this room remained to the height of more than two feet at the north-east corner, where was a funnel above the pavement, communicating with the hypocaust below. The pavement was in good preservation, and the dimensions of the room were forty feet four inches by seventeen feet. The first room thirty-one feet eleven inches by nineteen feet. The walls on the east, west, and north sides were two feet six inches thick, that on the south three feet. This is conjectured to have been the *triclinium*, or grand banqueting room. Another pavement was found in the room No. 6. At the end of this room, opposite from the room last mentioned, was a door-way three feet three inches and a half wide, leading into another room, twenty-two feet by ten feet four inches, the pavement formed of coarse red tesseræ. On the south side of the great pavement, the foundations of a cryptoporticus were discovered, marked 10, which appears to have been of much larger dimensions than any one hitherto discovered in this island; it was ten feet wide, and one hundred and fifty-seven feet six inches long. Its tessellated pavement was destroyed, except at the west end. On the north side of this gallery, the foundation walls of a range of rooms was discovered, running eastward in a line with the great room first discovered; the one which adjoined that room on the east side, marked 12, was nineteen feet two inches by eighteen feet nine inches, and had a floor of terras of a light red colour: the next room to the eastward, marked 13, was nearly of the same dimensions, and had a coarse tessellated pavement. Adjoining the two last-mentioned rooms on the north side were the foundations of one sixteen feet square, marked 8, containing a mosaic pavement. The *præfurnium* of the hypocaust, by which the great room and others had been heated, was discovered on the north side of the north wall of the room marked 6, and consisted of two walls eighteen inches thick, and eighteen inches asunder, projecting sixteen inches from the wall of the building: between them was a kind of arch formed by bricks projecting beyond each other, and communicating with the flues under the different pavements. About thirty feet north of the room marked 5, a very fine mosaic pavement was discovered, and a magnificent apartment marked 3, was traced, to which 5 was found to have served as an ante-room. The wall on the north side of this room was found to continue thirty-two feet towards the west, where it terminated with a projection or buttress of two feet, forming two sides of what appeared to have been a kind of court, (1) enclosing an area of thirty feet, filled with great quantities of stones, bricks, and tiles. At a small distance from the west wall of the great room, last described, the base and part of the shaft of a small column were discovered. At the west end of the ante-room 5, was a very small room 4, eight feet twelve inches by twelve feet, having two door-ways, one on the east opening into 5, and the other on the north communicating with the square area marked 1. The continuation of the east wall of the room 11, at the west end, or rather the continuation, of the cryptoporticus, was next explored to the southward, and traces of it were found to the extent of one hundred feet. The room 27, adjoining 26, had its walls still remaining, on the east, north, and south sides, to about two feet high, which were covered with stucco two inches thick, painted red, with a skirting of plaster, at two inches high, projecting two inches and a half from the wall. On the east side was found in good preservation a fire-place twenty-one inches and a half wide in front, seventeen at the back, and eight deep, with a hearth formed of eight bricks, each about seven inches square. The fire-place was formed by two brick tiles on each side, which had been cramped together with iron, and were placed as on the sides of the stove introduced by Count Rumford. "I am not aware," Mr. Lysons observes, "of any open fire-place of this kind having been discovered elsewhere in the remains of a Roman building, though it is certain, from various passages in the Roman writers, that other means were employed by the ancients for warming their apartments, besides hypocausts. The caminus is mentioned by Cicero, Horace, Vitruvius, and others, but the learned commentators on these authors are by no means agreed as to its form or situation; and it has been much questioned by some of them, on the authority of several passages in ancient writers, and from none having been discovered in Roman buildings, whether there was any chimney, or other means of conveying away the smoke; though it is hardly to be conceived, that a room could have been habitable under such circumstances, at times when it was necessary to close the doors and windows." This room was fourteen feet and a half by seventeen. The room 29 was sixteen feet five inches by fifteen feet six inches, and against the wall was another fire-place resembling the one described. The range of rooms running eastward from the great triclinium were found to extend the whole length of the cryptoporticus 10, 11. On the south side of the building, another cryptoporticus was discovered, marked 45, which communicated with a range of twelve rooms, containing nothing remarkable, except those at the east end, which furnished very interesting remains of the baths. The room 56 is nearly a square of twenty-five feet, and contained a finely preserved mosaic pavement. Beyond this mosaic pavement were three rows of black and red tiles, six inches square, laid checquer-wise, and next to the wall a row of bricks, each eleven inches by fifteen and a half. Great part of a small stone column was found on the pavement, in the same style as the fragment first discovered, being a sort of irregular Doric, the tori of the base being both of the same size. The adjoining room 55, was thirty feet by thirty-five, the floor formed of black and white stones, and, next to the wall, a row of bricks. Nearly in the middle was a cold bath, eighteen feet from east to west, and three feet two inches deep. It had three steps on the east, west, and north sides. On the west side of this room appeared the remains of an extensive hypocaust marked 53, 54; and from the frequency of the brick piers, it appeared that the apartment over it must have been a sudatory, probably divided into several smaller rooms. The præfurnium was on the outside of the wall at the south end; the piers were two feet nine inches high, and seven inches and a half square, and consisted of eighteen layers of bricks, with a larger one, ten inches and a half square, laid at the top and bottom. In the room 52, adjoining, was another hypocaust, communicating with the larger one by an arch of brick. The area No. 1, was, in another examination, found to be surrounded by an inner wall, which appeared to have formed a kind of portico; and an entire column was found, resembling the fragments found before, which shewed that it had been surrounded by a colonnade. A cold bath was also found in the apartment marked 21. Mr. Lysons thinks the villas to have been the residence of a *proprætor*, or at least of the legate or governor of the province. At the time Mr Lysons first communicated an account of this villa to the Archæologia, the discovery was confined to the rooms marked No. 1 to 26, and 28 to 44. During the years 1816 and 1817, by tracing the foundations of the walls on the east and west sides of the great court, it was discovered that the cryptoporticus extended all round. The western cryptoporticus 46, was eight feet wide, and one hundred and eight long, including a small room, 45, at the north end, which had a mosaic pavement. "Several rooms, No. 27, 51, 52, 53, 54, 55, 56, and 57, besides the cryptoporticus and passages, were discovered on the western side of the great court, most of them extending into an arable field, belonging to the rector of Bignor. No remains of pavements were discovered in this division of the building, except those in the cryptoporticus above mentioned, and some fragments of the courser kind in the rooms Nos. 28 and 29. Many large tesseræ were found among the rubbish in the passage No. 50. By digging further to the eastward of the single wall mentioned in the former account, that wall was ascertained to be part of an eastern cryptoporticus, Nos. 60 and 61, which completed the enclosure of the great court; and the foundations of buildings were discovered in the field called the Town-field, extending one hundred and eighty-one feet eastward, Nos. 62 to 71. Several of these buildings were of large dimensions, and they were enclosed within a boundary wall of considerable thickness; not built at right angles with the eastern side of the principal court, but in a very irregular manner; the following being dimensions of the several sides of this court: viz. the eastern side, two hundred and seventy-seven feet four inches; the west side, three hundred and eighty-five feet five inches; the north side two hundred and eighty-six feet;

and the south side, three hundred and twenty-two feet, eight inches." Other remains of Roman villas, of different dimensions and disposition, are described in the volumes of the Archæologia, before referred to.

The name of *villa* is still given to the country houses of the rich modern Romans, which, though not equal in splendour and extent to those of the ancients, may still be termed, with equal propriety, palaces. In the gardens which surround them, it is customary to plant fine hedgerows of laurels of every description, which, besides forming an agreeable variety, preserve their verdure in the midst of winter. The principal are the villa Albani, the villa Borghese, or Pinciana, the villa Pamphili, Mattæi, Barberini, Farnese, Piombino, with a multitude of others, on which the granite and porphyry of Egypt, the marbles of Africa and Paros, the sculptures and bas-reliefs of ancient Greece and Rome, and the paintings of the most eminent modern masters, are lavished with the most unsparing hand.

Some observations relating to English country houses will be found under the articles *House*, *Rural Architecture*, and *Cottage*.

The following extracts from Fosbrook's "Tourist's Grammar," will give a tolerable idea of the styles of the old English houses, particularly those in the country. "From the twelfth to the fifteenth century, houses were so low, that, in the former era, those in London are presumed to have been only sixteen feet high; and at Southwell College, first built in 1399, there were only two stories, the upper one being in the roof, which was so deep as to reach to the ceilings of the lower rooms." Even in the fifth century, the houses continued very low; and in the "Paston Letters," it is said, "Zvr housis her ben so low, yat yer may non man schet out wt no long bowe." The old part of the manor-house of Wootton, Kent, is supposed to be of the time of the Edwards. It was built of flint, the walls very thick, with here and there lancet windows; it had a little round tower, with a newel staircase, and thick studded folding doors under a pointed arch, which led to a chapel. The hall had formerly a carved wooden roof, painted with stars and other ornaments, two stories high, with Gothic windows. The Chronicle of Dunstable mentions the erection of carpenters' and wheelers' houses within the court of a manor-house, as early as the thirteenth century; so that all these encumbrances of offices are quite ancient, indeed they are Anglo-Saxon. In the illuminations of the *Roman d'Alexandre*, are several views of fortified houses with high gables, a fashion which was introduced from Flanders in the time of the first Edward. A specimen may be seen in Beverstone Castle, Gloucestershire, built during the reign of Edward III., of which a view is engraved in Grose. "In the sixteenth century there is a great elegance in the houses. Superb gateways; slender turrets; octangular stair-case; towers with or without domed tops, covered with lead; large projecting chimney stacks, topped by two, three, or four chimneys; tall, and often richly modelled brick; great square windows in profusion; projecting bay windows; lofty porches; and many other minute distinctions, of which the instances are frequent." "Escalloped gables are ascribed to the beginning of the seventeenth century." Figures, badges, and arms carved in wood, are generally of the sixteenth century; as are also overhanging projecting stories, though these latter sometimes occur in buildings of the latter end of the preceding century. Brick was not in use before the fifteenth century, and then very rare; for we hear of no good brick walls till the time of Charles I. In the time of James I. plain chimneys began to come into use, and the ornamental moulded chimneys were then laid aside. Of old country houses, as distinguished from castles, there were two styles: the first, the *English* low style, of only two stories, which was succeeded by the Flemish, with high gables, which fashion continued till the seventeenth century, when Inigo Jones introduced a style entirely new, characterized by a long handsome front, full of large windows. At Walford, in Herefordshire, we have a tolerable specimen of the fortified manor-houses, during the wars of Charles I. "The house was of the Flemish high-gable character, but it was thus guarded: in front it had a small raised recess, balustraded, and ascended by steps; this commanded a side-long entrance (the principal one) into a walled court of offices; that walled court, and a barn opposite, commanded the high road. Before arriving at the entrance, was a little walled court, which enfiladed the road. The south side of the house was flanked by a walled bowling-green and farmyard, (in which cannon-shot have been found,) and the side of the house here consists of a long room, where the soldiers were lodged. Supposing this court carried, beyond is an orchard, walled, and ha-haed on the inner side, with a mount in the centre; which orchard and mount again commands the bowling-green and farmyard. The road, winding in the rear, is enfiladed by a receding part of the orchard wall, by which shot could be fired straight up the road. The north side is protected by a walled garden and court, which are again commanded by the orchard. It was thus fortified, says tradition, in check of the neighbouring garrison at Goodrich castle; and very possibly could not have been taken without cannon, and a regular siege."

VILLAGE, a collection of country houses and cottages, with a church, &c.

The Roman *vicus* signified a quarter of a town, as well as a village; and every vicus had a *sacellum*, or chapel, like our villages, which served to fix the limits; and a *magister* (called *vico-magister*), who discharged the offices both of surveyor of the roads, and of constable.

VIMINAL; the Viminal hill, together with the Esquiline hill, form the fifth part of Rome; it was situated between the Esquiline hill to the east, and the Quirinal to the west.

VISUAL ANGLE, in perspective, the angle which the two rays, issuing from the two extreme points of an object, form at the centre of the eye.

VISUAL POINT, a point in the horizontal line where the ocular rays unite.

VISUAL RAYS, lines of light, supposed to come from the object to the eye.

VITRIFICATION, the hardening of argillaceous stones by heat. The remains of vitrified forts, in some parts of Scotland, prove that the North Britons were acquainted with the durability imparted to argillaceous stones by exposure to great heat. Several of them are described in different volumes of the Archæologia. In situations at a great distance from durable building stones, it would be advantageous to have the bricks employed in the construction of bridges exposed to a greater degree of heat, and vitrified on the surface. This may be more easily effected by a mixture of calcareous earth with the clay.

The walls of the *vitrified forts* in the highlands and northern parts of Scotland, have the appearance of having been melted into a solid mass, and have from their appearance caused some people to imagine that they are not works of art, but that they have been formed by the action of early volcanoes. They are generally situated on the top of small hills, commanding an extensive view of the adjacent valley or low country. The area on the summit is surrounded by a high and strong wall, of which the stones are melted, most of them entirely; while others, in which the fusion has not been so complete, are sunk in the vitrified matter in such a manner as to be quite enclosed in it; and in some places the fusion has been so perfect, that the ruins appear like masses of coarse glass. Mr. Williams, one of the first authors who has described them carefully, has advanced a conjecture on the mode in which they were constructed. Two parallel dikes of earth or sod being raised in the direction of the intended wall, with a space between them sufficient for its thickness, the fuel was put in, and set on fire. The stones best adapted for the purpose, called the *plum-pudding* stone, are every where to be found in the neighbourhood. These were laid on the fuel, and, when melted, were kept by the frame of earth from running off; and by repeating the operation, the wall was raised to a sufficient height. Mr. Williams mentions, in confirmation of his hypothesis, that a brick-kiln, situated on the declivity of one of these eminences, so as to be exposed to the wind, which happening to rise briskly one time when the kiln was burning, the heat was so much increased, that the bricks were melted, and ran like lava for a considerable way down the hill.

This conjecture of Mr. Williams, though warmly advocated by other writers, was opposed by Mr. Barrington, the summary of whose opinion on them is as follows. Having travelled for twenty-one years the most mountainous circuit in Wales, he frequently observed enclosures of dry stones, particularly a long tract in the western part of Merionethshire, called, in the language of the country, *Duffryn, i. e. the Vale.* On first viewing these enclosures, made within walls of thick stones, he was at a loss to imagine how it should be worth while to construct such strong fences for so inconsiderable a piece of ground as they enclosed; but, on examining the adjacent country, he says that he found it almost entirely covered with stones of a similar kind, and consequently the smaller the space to be cleared, the less expensive would be the removal. "For the same reason, such dry walls are often of a great thickness, and sometimes the corners of the enclosures are filled with stones to a great width, this being the only possible means of procuring pasture." To a practice of the same kind he would ascribe the works in Scotland: but it is a strong objection, that the walls of these latter are vitrified, and it can hardly be supposed that such trouble would be taken with fences made in so fortuitous a manner; and there is great difficulty in ascribing the vitrification to natural causes

Mr. Cardonnell, who follows the opinion of Mr. Williams, has given detailed accounts of some of these structures. The largest is situated on the hill of Knockfarrill, to the south of the valley of Strathpeffer, two miles to the west of Dingwall, in Ross-shire. The enclosure is a hundred and twenty feet long, and forty broad, within the walls; and is strengthened on the outside with works at each end. A range of habitations seem to have been erected against, or under, the shade of the outward wall, of which those on the south side appear to have been larger and higher than those on the north. There are two wells in the middle, which, on being cleared out, filled with water. On the skirts of the hill to the south are many detached buildings, which, from the stratum of dung found on removing the ruins, have evidently been used for securing cattle. This seems to have been a place of consequence in ancient times, and the residence of some powerful chief, from a road which leads through the hills on the north-west to the sea. To the east of the works are a number of vitrified ruins, extending for a considerable way along the ridge of the hill. The end next the fort seems to have joined the outer wall, and consisted either of two parallel walls closed above, with a passage between them under cover, or a high wall, broad enough to walk on. In this wall there are the vestiges of a break about the middle, over which a bridge has been laid, to be drawn up or removed as occasion might require.

The fort next in consequence to this, is that of Knockfarril, on the hill of Craig-Phadrick, near Inverness, which appears to have had two vitrified walls quite round the area, the inner one very high and strong, and the outer one but low, the area within the inner wall being nearly eighty paces long by twenty-seven broad. The best account of this ruin is given by Mr. Tytler, in the Edinburgh Philosophical Transactions, vol. ii. The hill itself is a small conical eminence, forming the eastern extremity of the ridge of mountains which bounds Loch Ness on the north-west side. It is accessible both from the west and south-east, on the former side being approached by a narrow level ridge which joins the hills on Loch Ness, and the latter by an easy access from the high ground above Inverness. On approaching the hill from the west, we first meet with a road cut through the rock from the bottom to the top, in most places ten feet broad, and nearly as deep, having a serpentine wind of about seventy feet, which leads us to an ascent over a steep rock, otherwise on that side quite inaccessible. This road, Mr. Tytler thinks, there is no doubt is the work of art, and the vitrified matter at the top is the only thing which indicates the effects of fire, there being no appearance of pumice-stone, lava, or basalt, or any thing of a volcanic nature, about the hill. "But the circumstance," he says, "which in his apprehension evinces, in the most satisfactory manner, that these appearances of the effect of fire on the summit of this hill are not the operations of nature, but of art, is the regular order and disposition of the materials, the form of the ground, and the various traces of skill and contrivance which are yet discernible, though considerably defaced, either by external violence, or the obliterating hand of time." In ascending by the road above mentioned, there appears, towards the middle, on the right hand, a small platform overhanging the passage, and inclining by a very gentle declivity to the very edge of the rock. Four enormous stones are placed upon the platform, and on the edge and extremity of it, which have evidently been guided by art into that position; it being impossible that they could have rested there, had they been rolled down from the higher parts. The obvious reason for placing them in such a position has been, that on an alarm of danger they might be projected into the path below, which could be done by the efforts of a very few men; and when this was done, the passage would be entirely obstructed, or at least rendered so difficult, that it could be defended by a few against any number of assailants. Some other large stones are placed on an eminence to the left, probably with a view to block up a hollow channel, by which an enemy might have attempted to ascend. When we come to the top of the hill, a few feet below the rampart which crowns the whole, there appears an outward wall, approaching on the sides of the hill so near the upper rampart, as to leave only a trench of ten or twelve feet between them. This outward wall is in some places so low as to be almost level with the rock, though in other places it rises to the height of two or three feet; but, even where lowest, it may be traced by a line of vitrified matter sticking fast to the rock all along, and nearly of the same breadth, which is about nine feet. The remains of this wall are strongly vitrified, except in one place on the north side, where, for about seventy yards, the rampart is formed only of dry stones and earth. At the east side, where the hill is more accessible, there is a prodigious mound of vitrified matter, extending to a thickness of about forty feet. At the south-east corner, and adjoining to this immense mound, is an outwork, consisting of two semicircular vitrified walls, with a narrow pass cut through them in the middle, which appears to have been another, and perhaps the principal, entrance to the fort. The inner wall, surrounding the summit of the hill, encloses an oblong level area, rounded at each end like the outer wall. It is of considerable height, and nearly of the same thickness as the outer one. It has some appearance of having been defended by four turrets or bastions, but the traces of them are very imperfect. A number of small earthen tumuli, with a stone in the centre, were more discernible. On the east side, a portion of the internal space appears separated from the rest by two ranges of stones fixed strong in the earth, and forming a right-angled parallelogram. "This separation," Mr. Tytler says, "is immediately discernible by the eye, from this circumstance, that the whole of the enclosed summit has been most carefully cleared from stones, of which there is not one to be seen, unless those that form this division, and the single one in the middle of the circle of tumuli above mentioned. What has been the design of this separated space, it is difficult to conjecture. It might, perhaps, have marked the residence of those of a higher rank, or served as a temple for the purposes of devotion." On the east end of the large area on the summit, is a well of about six feet in diameter, which has probably been sunk very deep in the rock, though now it is filled up with rubbish to within a yard of the top.

The other fortified hills mentioned by Mr. Cardonnell, are those of Dun-Evan, in Nairnshire, Tordun Castle, near Fort Augustus, Gleneves, in Lochaber, three miles to the south of Fort William. The Castlehill of Finhaven, in Angusshire, has likewise some considerable ruins of the same kind, as has also the hill of Noth.

The opinions of different writers, on the origin of these structures, are so various and contending, that it would serve no purpose to introduce them; and the difficulties that occur, to whatever opinion we incline, are so numerous, that it would require an article of too great length, to give them all a proper consideration.

VITRUVIUS, M. POLLIO, a celebrated ancient architect, supposed to have flourished under Julius Cæsar and Augustus, and who occupied the place of military engineer under one of the emperors. He is generally supposed to have been born at Formiæ, though Verona and Placentia both put in their claim for being his birth-place. He mentions one edifice on which he was employed, a basilica at Fano. Some of the best editions of his works are those edited by Dan. Barbari, fol. Venet. 1567. J. de Laet; fol. Amst. 1649. Guliani, fol. Neap. 1758, with an Italian version. It has been translated into French, by Claude Perrault, fol. Par. 1684; and we have two good translations in English, by Mr. Newton, Lond. 1791, and by Mr. Wilkins. This work was discovered in MS. by Poggio, in the fifteenth century.

VOLUTE, a spiral scroll, which forms the principal characteristic of the Ionic and Composite capitals. See *Capital*, *Canal*, &c.

In plate, *Carpentry*, C. xix. *fig.* 5, is shown the manner of describing the volute of the Erectheion at Athens, as given by Nicholson. From the centre, which is marked 20 upwards, which will give the extremity of the first radius upwards. Upon the second radius to the left, set 18.3 from the centre. This will give another point in the curve. Then, following, round in the same progression, from the centre set-off, upon each succeeding radius respectively, 16.74; 15.32; 14.01; 12.82; 11.73; 10,73; 9.82, &c. to 2.37; and three points will have been found in each quadrant: in the first quadrant, take the length of the middle radius, 18.3, set one foot of the compass in 20, then describe an arc near the centre; set the foot of the compasses again in 16.7, and with the same radius describe an arc cutting the former. From the point where the two arcs intersect, as a centre, describe an arc cutting the three points, 20, 18.3, 16.7. Proceed in the same manner with every quadrant, till you arrive at 2.37, and with the radius 2.37 describe a circle, which will complete the spiral. This operation must be repeated for every line in the volute, as no two are struck from the same centre.

Other examples of volutes will be found in different plates of our work, as in those which illustrate the article *Athenian Architecture*.

In plate, *Carpentry*, C 41, is given a capital from an Ionic colonnade, near the Lantern of Demosthenes at Athens; and, in one of the volutes is shown the mode of striking it, which Mr. Revett discovered by some marks of the compass in the eye of the volute of the original capital. Below is shown the eye on a larger scale. In the three figures in the centre of plate *Carpentry*, C 28, is shown a method of finding centres for drawing spirals to any number of revolutions; the centre, C, being given, and also the perpendicular line CG. Make CD both perpendicular, and equal to CG; divide CD, beginning at C, into as many equal parts as you intend to have revolutions; divide the first of these from the centre C, that is, C 1, into two equal parts, at the point I; through the point DG, draw DB and GB respectively, parallel to CG and CD, cutting each other at B; in the line BG, join CA and CB; through I, draw IE, parallel to CA, cutting BD, produced at E; through the same point I, draw IF, parallel to CB; then, through the point D, *fig.* 1; and 1, D, *fig.* 2: 1, 2, D, *fig.* 3, &c., draw the lines parallel to BE, cutting the diagonal EI and BC. From the points where the diagonals are cut, draw lines parallel to BA, cutting the other diagonals AC and FI; and, through the points which are cut in the diagonals AC or FI, draw lines again parallel to BE, and it will complete the centres for turning the volute.

VOMITORIA, (Lat.) gates or doors in the ancient amphitheatres, by which the spectators entered, and which led to the seats.

VOUSSOIRS, (Fr.) stones placed like wedges, and employed in forming the arch of an arcade, &c.

W.

WAGGON-HEADED CEILING, see *Cylindric Ceiling.*

WAINSCOT, the wooden lining of walls, generally in panels. The wood, originally used in this work, was a foreign oak, known by this name, and hence the name by degrees became applied to the work itself.

WALL, (*vallum*, Lat.) a body of masonry, of a certain thickness, formed of stone or bricks. The early Greeks constructed their walls, particularly those which surrounded their cities, of rough stones of an immense size; such were those of Mycenæ and Tiryns. See *Cyclopian Architecture, Tiryns*, and the articles there referred to. The interstices that were left between these shapeless blocks, were filled up with small stones. According to the report of travellers, there still exist in the isles of Gozzo and Malta circular edifices of this construction. When the ancients began to cut their stones, they did not cut them rectangular, but gave them an irregular figure of three, four, or six sides, but fitted them together, so that, when in their places, they left no interstices between them. The ruins of the ancient wall about the city of Cora, near Velletri, are an example of this mode of building. Winckelmann makes the same remark on the walls of Corinth; on those of Eretria, in Eubœa; and of Ostia, in Cyprus. We also find in the ancient Lesbos, now called Metelino, and in different parts of Greece and Asia Minor, vestiges of similar walls. Chandler gives to this construction the name of *incertum*, and takes it, without doubt, for the *incertum* of Vitruvius. But the mode of building which the Roman architect speaks of under that name, is of a very different character. The ancients next employed stones cut at right angles, and of an oblong form, but their size was not uniform. We find the remains of such walls in Greek and Etruscan buildings. The stones are generally from nine to twenty-two feet long, and from two to six high, in the walls of Volaterra, Cortona, and Pæstum; those of the latter city have been restored by the Romans. Sometimes they gave to the exterior of these stones the form of a rhombus or lozenge, as we see in the ancient walls in the isle of Syra, and in Samos. As by degrees the Greeks brought their architecture to perfection, they constructed their buildings in a manner more agreeable, more regular, and less gigantic. There were three different modes of building:—the *isodomum*, which was formed of ranges of large stones of equal height, and which consequently gave to the buildings in which it was employed a handsome appearance, and was, therefore, chiefly employed in the construction of temples; the *pseudisodomum*, which consisted of ranges of stones of unequal height; and the *emplecton*, which was employed when it was requisite to give a thickness greater than ordinary to the walls, and in which the outside only of the walls was built up of regular hewn stones, and the interior part filled with rough stones and mortar. For the sake of greater solidity, they placed with care at certain distances cross-stones, which served to bind the two outer faces.

The Romans at first imitated the Etruscans in their manner of building. But in later times, independent of the use of bricks and hewn stones, the Romans had two modes of building, which they called *reticulatum*, and *incertum* or *antiquum*. The *incertum* consisted in employing the stones just as they came from the quarries, ranged in any order, as they could best fit them together. What was called *reticulatum opus*, was a wall composed of square stones, which were not placed in a horizontal direction, but in such a manner, that the junctures lay in a horizontal line, which gave the wall the appearance of net-work, whence it received the name of *reticulatum*, and was called by the Greeks *dictyotheton*. Vitruvius assures us, that in his time this was the mode of building most commonly practised. Many edifices of this construction still remain. The Romans imitated the *emplecton* of the Greeks, but they did not execute it with the same care or the same solidity. They employed also stone and brick at the same time; and the order and symmetry, which is observed in walls of this construction, lead us to conclude, that their aim was to adorn and embellish them.

The Romans built sometimes also with wood, filling up the intervals with masonry of stones and bricks. This construction, however, was only admitted in the interior of buildings, in some particular houses, and in theatres, &c., which were not intended to last long. Walls of earth and clay were not unknown to the Romans, who learnt this mode of construction from the Carthaginians. It has been renewed in late years under the name of *pisé*. See *Pisé*.

The walls of Armaira, in Persia, are described by Sir R. K. Porter. Some of the towers are of prodigious magnitude, and exhibit the finest specimens of the ancient high-finished Armenian masonry, being composed of white and reddish stones, joined in alternate lines with the nicest art. The common thickness of Grecian walls was seven or eight feet. Those of the Acropolis of Pharsalia are fifteen and a half feet thick. They are constructed sometimes with one single row of blocks, but more generally with a double row, united without any space in the middle. Those on Pharsalia and other places, where they are of an unusual thickness, are lined on both sides with large blocks, while the interstices are filled up with smaller stones, and earth or mortar, the *emplecton* of Vitruvius. The ancient Cyclopean walls were an exception, being twenty-five feet thick at Tiryns, and solid throughout. The walls of Platara, which in some parts are in a high state preservation, exhibit the mode of building walls in Greece, in the age of Alexander, when they were rebuilt. They are in general composed of regular masonry, with some irregularity in the size of the stones, which does not appear to be symmetric. They are about eight feet thick, and are fortified by square towers, with a few of a circular form.

The process of laying the foundations of walls has been described under the article *Foundation.*

When bricks are laid in dry weather, and the work is required to be firm, the bricks should be wetted by dipping them in water, or by throwing water over them before they are used. This is particularly serviceable where work is carried up thin, or in putting in furnaces, grates, &c. In frosty and stormy weather, walls newly built should be covered with straw or boards; the former is the best, because it protects in some measure the top of the wall from frost, which, particularly after rain, is very destructive, as it freezes and expands the water, which has already penetrated into every part of the wall. In working up a wall, it will be proper not to work more than four or five feet at a time; for, since all walls have a tendency to shrink immediately after building, the part which has been first raised will remain stationary; and when the part which adjoins to it has been raised up to the same height, it will shrink, and consequently separate itself from that part previously raised, causing a crack.

The term *bond* is given to any disposition of bricks, which interrupts the continuity of the joints of a wall in a straight line; and, although a bond might be introduced, that would interrupt the rectilinear direction both of the horizontal and vertical joints of a wall, yet two kinds of bonds only are used, and these both interrupt only the vertical joints, the horizontal ones being continued in the same line round the whole building. When the wall is only required to be half a brick in thickness, all the bricks are laid in such a position as to form what are termed *ſtretchers,* that is, their length is laid in the direction of the wall, the bond being formed merely by making the vertical joints in every course, exactly opposite the middle of the bricks above and below. When, however, the wall is of a greater thickness, as of the length of a brick or upwards, the bricks must be connected in their breadth, as well as their length, or it would be liable to split open, if it consisted only of two walls separately bonded.

The two ways of bonding thick walls, which materially differ from each other, are known by the denomination of the *English bond,* and *Flemish bond.* The following observations are chiefly taken from a pamphlet on this subject, by Mr. G. Saunders:—Old English bond is a continuation of one kind throughout in the same course or horizontal layer, and consists of alternate layers of headers and stretchers, (or of bricks laid crossways, and bricks laid lengthways,) the headers serving to bind the wall together in a longitudinal direction, or lengthways; the stretcher, to prevent the wall splitting crossways or in a transverse section. Of these two evils, the former is by much the worst kind, and is therefore most dreaded by the bricklayer. The old English brickwork is the best security against these accidents, as work of this kind, when so much undermined as to cause a fraction, never separates in either of these ways, but breaks through the solid brick, as though the wall were composed of one entire piece. The Roman brickwork was generally of this kind of bond, but the specimens that remain of Roman work are generally of great thickness, and have three or more courses of brick, laid at certain intervals of the height, stretchers on stretchers, and headers on headers, opposite the return wall, and sometimes at certain distances in the length, forming piers, that bind the wall together in a transverse direction. *Flemish* bond consists in placing in the same course alternate headers and stretchers, which disposition is inferior in every thing but appearance, and even in this the difference is trifling. Bricks of two qualities are used in this method: a finer brick, often rubbed, and laid in what the workmen call a putty-joint, for the exterior, and an inferior brick for the interior, substance of the wall. As these did not correspond in thickness, the exterior and interior surface of the wall would not be otherwise connected together, than by an outside heading-brick, that was here and there continued of its whole length. But these headers sometimes cannot occur for a considerable space, as the work does not admit of them at all times, from the want of agreement in the exterior and interior courses, and they can only be introduced where such a correspondence takes place. Walls of this kind consist of two faces of four-inch work, with very little to connect them together: and the interior face often consists of brick little better than rubbish. The practice of the Flemish bond was introduced in the time of William and Mary, and, notwithstanding its inferiority, has become the method in general practice.

To the Flemish bond alone must be attributed the frequent splitting of walls into two thicknesses; and various schemes have been adopted to prevent this defect, but with little success. In the old English bond, the outside of the last course points out how the next is to be laid, so that the workman cannot easily err. The outside appearance, Mr. Saunders observes, is all that can be urged in favour of Flemish bond; but he thinks that, were the English bond executed with the same attention and neatness that is bestowed on the Flemish, it would be considered as equally handsome; and he strongly advocates the adoption of the old English bond, recommending the following as directions for the use of it. 1. Let each course be alternately of headers and stretchers. 2. Every brick in the same course ought to be laid in the same direction; but in no instance must a brick be placed with its whole length along the side of another, but to be so situated, that the end of one may reach to the middle of the others which lie contiguous to it, except the outside of the stretching course, where three-quarter bricks necessarily occur at the ends, to prevent a continued upright joint in the face-work. 3. A wall which crosses at a right angle with another, will have all the bricks, in the same level course, in the same parallel direction, which will completely bond the angles.

Wall-Plates, pieces of timber which are placed as to form the supports to the roof of a building.

Wall, Adrian's, see *Adrian's Wall.*

Wall, Long, at Athens. See *Macra Teiché.*

Warping, see *Lasting*.

Water. In erecting buildings, &c. which are exposed to the action of streams of water, it is very requisite to understand the theory of the motion of water in different cases. It is asserted, as a leading proposition, that, "when water flows uniformly on any channel or bed, the accelerating force which obliges it to move, is equal to the sum of all the resistances which it meets with, whether arising from its own viscidity, or from the friction of its bed." The truth of this proposition is evident; and it is the basis of all uniform motion. As the nature of our work will not allow our running out to too great a length on this subject, we shall content ourselves with stating some of the principal propositions.

Water issuing from a small orifice in the bottom or sides of a very large vessel, almost instantly acquires and maintains the velocity which a heavy body would acquire by falling to the orifice from the horizontal surface of the stagment water: this may be termed its *natural velocity*. If, therefore, we multiply the area of the orifice by this velocity, the product will be the quantity of water discharged, which may be called the *natural discharge*, and may be designated by N. Let O represent the area or section of the orifice, and h its depth under the surface; g the velocity acquired by a heavy body during a second, while falling; V $=$ the medium velocity of the water's motion, Q the quantity of water discharged during a second. Now $V = \sqrt{2g} \times \sqrt{h}$; therefore, $N = O\sqrt{2g}\sqrt{h}$. Now, since a body acquires the velocity of 32 feet two inches in a second, we have—

$2g = 772$ inches,

and $\sqrt{2g} = 27.78 = 27\frac{3}{4}$ inches nearly

$V = \sqrt{772} \cdot \sqrt{h} = 27.78\sqrt{h}$,

and $N = O\ 27.78\sqrt{h}$.

However, it appears, upon trial, that if we calculate the discharge for every orifice by this simple rule, owing to various trifling circumstances which do not enter into the calculation, we always find it greater than it really is. Of these circumstances, that termed *contraction* is the most important. When water issues through a hole in a thin plate, the lateral columns, pressing into the hole from all sides, cause the issuing filaments to converge to the axis of the jet, and contract its dimensions at a little distance from the hole. In this place of greatest contraction, the water acquires that velocity, which we observe in our experiments, and which we assume equal to that acquired by falling to the surface. It is the most convenient way, therefore, to compute from the real dimensions of the orifice, and to correct this computed discharge, by means of an actual comparison of the computed and real discharges in a series of experiments made in situations resembling those cases which most frequently occur in practice. The principle of contraction holds good in a great degree in all cases where fluids are made to pass through narrow places, as in the entry of pipes, canals, and sluices, and even at the heads of dams, and weirs. Michelotti and Bossut made many experiments to determine the effects of contraction in these cases. The results of their experiments, which scarcely differ from each other, are as follow. The numbers in the last column are the cubical inches of water discharged in a second, when the height (h) is one inch.

N, the natural discharge	= 10000	$= 27.78\sqrt{h}$
Q, for a thin plate almost at the surface . .	= 6526	$= 18.13\sqrt{h}$
— ditto, at the depth of eight feet	= 6195	$= 17.21\sqrt{h}$
— at the depth of sixteen	= 6173	$= 17.15\sqrt{h}$
Q, for a tube two diameters long	= 8125	$= 22.57\sqrt{h}$
— ditto, when projecting inwards and flowing full	= 6814	$= 18.93\sqrt{h}$
— ditto, with a contracted jet	= 5137	$= 14.27\sqrt{h}$
Q, for a weir	= 9536	$= 26.49\sqrt{h}$
Q, for a bar	= 9730	$= 27.03\sqrt{h}$

The calculations for the weir and bar relate only to the contractions occasioned by the passage over the edge of the board: the weir may also suffer a diminution by the contractions at its two ends, if it should be narrower than the stream, which is generally the case, because the two ends are commonly of square masonry or woodwork, when the contraction is nearly the same as that at the edge of a thin plate.

The diminution of discharge through a sluice, also, could not be expressed in the foregoing table, because when a sluice is drawn up, its lower edge still remaining under water, the discharge is contracted both above and at the sides, and the diminution of the exchange by each is proportionate to its extent. We may often observe the water, when coming out of a sluice into a mill-course, quit the edge of the aperture, and show a part of the bottom quite dry. This is always the case when the velocity of the efflux is considerable; but if the sides of the entry have a slope, this void space can never appear, though there is always this tendency to conveyance, which diminishes the quantity of the discharge.

When the water is observed to be actually moving with a velocity V, and we know whether it is coming over a dam, through a thin plate, tube, &c. the following are the formulas for the pressure, or head of water (h) which has actually produced this velocity.

$$h \text{ for the natural discharge} = \frac{V^2}{772}$$

$$h \text{ for a thin plate} \;.\;.\; = \frac{V^2}{296}$$

$$h \text{ for a tube 2 diam. long} = \frac{V^2}{505}$$

$$h \text{ for a dam or weir} \;.\; = \frac{V^2}{726}$$

$$h \text{ for a bar} \;.\;.\;.\;.\; = \frac{V^2}{746}$$

The following are the results of M. Buat's experiments on the uniform motion of water.

Let V represent the mean velocity in inches per second, of any current of water, running uniformly in a pipe or open channel, whose section, figure, and slope, are constant, but its length indefinite.

$d =$ the hydraulic mean depth, or the quotient arising from the division of the section of the channel (expressed in square inches), by its border, (expressed in linear inches.)

$s =$ the slope of the pipe or surface of the current, found by dividing the expanded length of the pipe or channel, by the difference of height of its two extremities.

$g =$ the velocity (in inches per second) of a heavy body falling during one second.

$n =$ an abstract constant number, determined by experiment, to be = 243.7.

L = the Napierian logarithm of the quantity to which it is prefixed.—Then we shall have, in every instance,

$$V = \frac{\sqrt{ng}\,(\sqrt{d} - 0.1)}{\sqrt{s} - L\sqrt{s+1.6}} - 0.3\,(\sqrt{d} - 0.1)$$

$$= \frac{307(\sqrt{d} - 0.1)}{\sqrt{s} - L\sqrt{s+1.6}} - 0.3\,(\sqrt{d} - 0.1)$$

Among other experiments made by different people, the following were made with a wooden canal. The values are all given in inches.

(1) With a canal of trapezium form.

Section of Canal.	Border of Canal.	Values of $\sqrt{d}$	Values of (s)	Mean velocity observed.	Mean velocity calculated.
18.84	13.06	1.20107	212	27.51	27.19
50.6	29.5	1.3096	212	28.92	29.28
83.43	26.	1.7913	412	27.14	28.55
27.2	15.31	1.3329	427	18.28	20.39
39.36	18.13	1.4734	427	20.3	22.71
50.44	20.37	1.5736	427	22.37	24.37
56.43	21.5	1.6201	427	23.54	25.14
98.74	28.25	1.8696	432	28.29	29.06
100.74	28.53	1.8791	432	28.52	29.23
119.58	31.06	1.9622	432	30.16	30.60
126.2	31.91	1.9887	432	31.58	31.03
130.71	32.47	1.0064	432	31.89	31.32
135.32	33.03	1.0241	432	32.32	31.61
20.83	13.62	1.2367	1728	8.94	8.58
34.37	17.	1.4219	1728	9.71	9.98
36.77	17.56	1.4471	1728	10.45	10.17
42.01	18.69	1.4992	1728	12.34	10.53

The following experiments were made with a rectangular canal.

34.5	21.25	1.27418	458	20.24	18.66
86.25	27.25	1.77908	458	28.29	26.69
34.5	21.25	1.27418	929	13.56	11.53
35.22	21.33	1.28499	1412	9.2	10.01
51.75	23.25	1.49191	1412	12.1	11.76
76.19	26.08	1.70921	1412	14.17	13.59
105.78	29.17	1.90427	1412	15.55	15.24
69.	25.25	1.65308	9288	4.59	4.56
156.25	35.25	2.09868	9288	5.7	5.86

The following were made on the canal of Jard.

Section of Canal.	Border of Canal.	Values of $\sqrt{d}$	Values of (s)	Mean velocity observed.	Mean velocity calculated
16252	402	6.3583	8919	17.42	18.77
11905	366	5.7032	11520	12.17	14.52
10475	360	5.3942	15360	15.74	11.61
7858	340	4.8074	21827	9.61	88.38
7376	337	4.6784	27648	7.79	7.07
6125	324	4.3475	27648	7.27	6.55

And those which follow on the river Haine.

31498	569	7.43974	6048	35.11	27.62
38838	601	8.03879	6413	31.77	28.76
30905	568	7.37632	32951	13.61	10.08
39639	604	8.10108	35723	15.96	10.53

The numerator of the fraction which expresses the velocity of a river, &c. in uniform motion has $\sqrt{d}$ for one of its factors, and, therefore, that form is the most favourable to the motion, which gives the greatest value to d; that form is the semicircle, which makes $d =$ half the radius. This form should be adopted for all aqueducts, &c. formed of masonry, but on account of the ease and accuracy in the execution, engineers have generally preferred a rectangular form.

In the following tables, the values of the formulas of M. Buat, before mentioned, are calculated for every declivity that can occur in water-pipes, canals, or rivers.

Table I. Logarithms of the values of the numerator of the fraction $307\frac{(\sqrt{d}-0.1)}{\sqrt{s}-L\sqrt{s+1.6}}$ for every value of the hydraulic mean depth (*d*). Also, the value of 0.3 ($\sqrt{d}$ — 0.1).

d	Log. of 307 ($\sqrt{d}$ — 0.1.)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3($\sqrt{d}$ — 0.1.)
0.1	1.82208	.06	2.4	2.64827	.44	4.7	2.80269	.62	7.	2.89296	.76
0.2	2.02786	.1	2.5	2.65772	.45	4.8	2.80747	.63	7.1	2.89614	.77
0.3	2.13753	.13	2.6	2.66681	.45	4.9	2.81216	.63	7.2	2.89930	.77
0.4	2.21343	.16	2.7	2.67556	.46	5.	2.81674	.64	7.3	2.90241	.78
0.5	2.27040	.18	2.8	2.68395	.47	5.1	2.82125	.65	7.4	2.90549	.78
0.6	2.31618	.2	2.9	2.69207	.48	5.2	2.82567	.65	7.5	2.90851	.79
0.7	2.35441	.22	3.	2.69989	.49	5.3	2.83000	.66	7.6	2.91150	.79
0.8	2.38719	.24	3.1	2.70743	.5	5.4	2.83222	.67	7.7	2.91445	.8
0.9	2.41588	.25	3.2	2.71472	.51	5.5	2.83840	.67	7.8	2.91734	.8
1.	2.44138	.27	3.3	2.72181	.52	5.6	2.84248	.68	7.9	2.92022	.81
1.1	2.46431	.28	3.4	2.72866	.53	5.7	2.84648	.68	8.	2.92305	.82
1.2	2.48518	.3	3.5	2.73531	.53	5.8	2.85043	.69	8.1	2.92584	.82
1.3	2.50426	.31	3.6	2.74178	.54	5.9	2.85431	.69	8.2	2.92860	.83
1.4	2.52185	.32	3.7	2.74804	.55	6.	2.85812	.7	8.3	2.93133	.83
1.5	2.53818	.34	3.8	2.75417	.56	6.1	2.86185	.7	8.4	2.93403	.84
1.6	2.55345	.35	3.9	2.76009	.56	6.2	2.86554	.71	8.5	2.93670	.84
1.7	2.56769	.36	4.	2.76589	.57	6.3	2.86916	.72	8.6	2.93933	.85
1.8	2.58112	.37	4.1	2.77153	.58	6.4	2.87271	.73	8.7	2.94192	.85
1.9	2.59381	.38	4.2	2.77704	.59	6.5	2.87622	.73	8.8	2.94449	.86
2.	2.60580	.39	4.3	2.78240	.59	6.6	2.87966	.74	8.9	2.94703	.86
2.1	2.61713	.4	4.4	2.78765	.6	6.7	2.88306	.75	9.	2.94954	.87
2.2	2.62803	.41	4.5	2.79277	.6	6.8	2.88641	.75	9.1	2.95202	.87
2.3	2.63839	.42	4.6	2.79779	.61	6.9	2.88971	.76	9.2	2.95447	.88

TABLE I.—CONTINUED.

d	Log. of 307 ($\sqrt{d}$—0.1)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3($\sqrt{d}$ — 0.1.)	d	Log. of 307 ($\sqrt{d}$—0.1.)	0.3)$\sqrt{d}$ —0.1.)
9.3	2.95690	.88	28	3.20243	1.56	53	3.34327	2.15	78	3.42283	2.62
9.4	2.95930	.89	29	3.21020	1.58	54	3.34738	2.17	79	3.43103	2.63
9.5	2.96167	.89	30	3.21770	1.61	55	3.35143	2.19	80	3.43380	2.65
9.6	2.96402	9	31	3.22495	1.64	56	3.35539	2.27	81	3.43653	2.67
9.7	2.96634	.9	32	3.23196	1.67	57	3.35928	2.23	82	3.43923	2.69
9.8	2.96865	.91	33	3.23877	1.69	58	3.36312	2.25	83	3.44189	2.7
9.9	2.97093	.91	34	3.24537	1.72	59	3.36687	2.27	84	3.44452	2.72
10	2.97319	.92	35	3.25176	1.74	60	3.37057	2.3	85	3.44712	2.74
11	2.99454	.97	36	3.25799	1.77	61	3.37421	2.31	86	3.44968	2.75
12	3.01401	1.01	37	3.26404	1.79	62	3.37778	2.33	87	3.45222	2.77
13	3.03189	1.05	38	3.26993	1.82	63	3.38130	2.35	88	3.45473	2.78
14	3.04843	1.09	39	3.27566	1.84	64	3.38477	2.37	89	3.45721	2.79
15	3.06383	1.13	40	3.28125	1.87	65	3.38817	2.39	90	3.45965	2.81
16	3.07820	1.17	41	3.28669	1.89	66	3.39158	2.41	91	3.46208	2.83
17	3.09170	1.21	42	3.29201	1.91	67	3.39483	2.42	92	3.46448	2.85
18	3.10441	1.24	43	3.29720	1.93	68	3.39809	2.44	93	3.46685	2.86
19	1.11644	1.28	44	3.30227	1.95	69	3.40130	2.46	94	3.46920	2.88
20	3.12783	1.31	45	3.30722	1.98	70	3.40446	2.48	95	3.47152	2.89
21	3.13867	1.34	46	3.31207	2.	71	3.40758	2.49	96	3.47381	2.91
22	3.14899	1.38	47	3.31681	2.03	72	3.41065	2.51	97	3.47608	2.93
23	3.15885	1.41	48	3.32145	2.05	73	3.41369	2.53	98	3.47833	2.94
24	3.16828	1.44	49	3.32599	2.07	74	3.41667	2.55	99	3.48056	2.95
25	3.17734	1.47	50	3.33043	2.09	75	3.41962	2.57	100	3.48277	2.97
26	3.18601	1.5	51	3.33480	2.11	76	3.42253	2.58			
27	3.19438	1.53	52	3.33908	2.13	77	3.42540	2.60			

TABLE II. Logarithms of the values of the denominator of the fraction $\frac{307\,(\sqrt{d}-0.1)}{\sqrt{s}-L\sqrt{s+1.6}}$ for every value of the slopes.

s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$	s	Log. of $\sqrt{s}-L\sqrt{s-1.6}$
1.	9.71784	3.5	.02373	6.	.15697	8.5	.24532	19	.45439	44	.67413	69	.79092
1.1	9.74210	3.6	.03064	6.1	.16113	8.6	.24832	20	.46776	45	.67997	70	.76463
1.2	9.76388	3.7	.03733	6.2	.16522	8.7	.25128	21	.48044	46	.68574	71	.79824
1.3	9.78376	3.8	.04383	6.3	.16927	8.8	.25422	22	.49262	47	.69135	72	.80182
1.4	9.80202	3.9	.05015	6.4	.17322	8.9	.25709	23	.50433	48	.69688	73	.80536
1.5	9.81882	4.	.05638	6.5	.17713	9.	.25996	24	.51549	49	.70226	74	.80882
1.6	9,83461	4.1	.06245	6.6	.18099	9.1	.26281	25	.52621	50	.70749	75	.81231
1,7	.984930	4.2	.06839	6.7	.18477	9.2	.26560	26	.53656	51	.71265	76	.81571
1.8	9.86314	4.3	.07412	6.8	.18854	9.3	.26839	27	.54654	52	.71767	77	.81908
1,9	2,87622	4.4	.07898	6.9	.19229	9.4	.27116	28	.55606	53	.72263	78	.82236
2.	9.88857	4.5	.08533	7.	.19584	9.5	.27387	29	.56526	54	.72746	79	.82562
2.1	9.90031	4.6	.09081	7.1	.19886	9.6	.27656	30	.57415	55	.78223	80	.82885
2.2	9.91153	4.7	.09615	7.2	.20298	9.7	.27921	31	.58263	56	.73695	81	.83206
2.3	9.92267	4.8	.10131	7.3	.20651	9.8	.28186	32	.59095	57	.74155	82	.83525
2.4	9.93247	4.9	.10644	7.4	.20997	9.9	.28450	33	.59901	58	.74601	83	.83835
2.5	9.94231	5.	.11147	7.5	.21336	10	.28709	34	.60692	59	.75043	84	.84142
2,6	9,95173	5.1	.11635	7.6	.21674			35	.61448	60	.75481	85	.84442
2,7	9.96085	5.2	.12108	7.7	.22109	11	.31170	36	.62180	61	.75906	86	.84739
2.8	9.96942	5.3	.12595	7.8	.22335	12	.33425	37	.62900	62	.76328	87	.85074
2.9	9,97818	5.4	.13061	7.9	.22663	13	.35488	38	.63599	63	.76745	88	.85327
3.	9.98632	5.5	.13519	8.	.22982	14	.37420	39	.64276	64	.77151	89	.85618
3.1	9.99427	5.6	.13970	8.1	.23297	15	.39235	40	.64933	65	.78276	90	.85908
3.2	0.00200	5.7	.14410	8.2	.23611	16	.40926	41	.65571	66	.77945	91	.86189
3.3	.00945	5.8	.14844	8.3	.23023	17	.42521	42	.66200	67	.78333	92	.86463
3.4	.01669	5.9	.15274	8.4	.24229	18	.44028	43	.66811	68	.78718	93	.86741

TABLE II.—CONTINUED.

s	Log of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$	s	Log. of $\sqrt{s}$— L $\sqrt{s-1.6}$
94	.87017	320	1.17612	610	1.33226	900	1.42487	2800	1.68971	5700	1.85237	8600	1.94551
95	.87286	330	1.18363	620	1 33614	910	1.42746	2900	1.69780	5800	1.85634	8700	1.94811
96	.87552	340	1.19092	630	1.33997	920	1.43005	3000	1.70558	5900	1.86022	8800	1.95069
97	.87818	350	1.19803	640	1.34373	930	1.43263	3100	1.71313	6000	1.86404	8900	1.95324
98	.88076	360	1.20490	650	1.34743	940	1.43515	3200	1.72042	6100	1.86778	9000	1.95576
99	.88338	370	1.21158	660	1.35108	950	1.43464	3300	1.72750	6200	1.87146	9100	1.95826
100	.88593	380	1.21806	670	1.35468	960	1.44011	3400	1.73435	6300	1.87507	9200	1.96073
—	—	390	1.22435	680	1.35823	970	1.44254	3500	1.74099	6400	1.87863	9300	1.96317
110	.91014	400	1.23048	690	1.36170	980	1.44498	3600	1.74746	6500	1.88213	9400	1.96559
120	.93212	410	1.23647	700	1.36513	990	1.44737	3700	1.75373	6600	1.88558	9500	1.96797
130	.95236	420	1.24232	710	1.36851	1000	1.44976	3800	1.75984	6700	1.88898	9600	1.97033
140	.97109	430	1.24805	720	1.37185	—	—	3900	1.76578	6800	1.89233	9700	1.97267
150	.98843	440	1.25360	730	1.37513	1100	1.47223	4000	1.77159	6900	1.89564	9800	1.97497
160	1.00466	450	1.25903	740	1.37839	1200	1.49269	4100	1.77725	7000	1.89891	9900	1.97726
170	1.01983	460	1.26433	750	1.38157	1300	1.51148	4200	1.78277	7100	1.90214	10000	1.97952
180	1.03410	470	1.26951	760	1.38471	1400	1.52885	4300	1.78814	7200	1.90532	11000	2.00099
190	1.04751	480	1.27461	770	1.38782	1500	1.54497	4400	1.79339	7300	2.90845	12000	2.02056
200	1.06026	490	1.27957	780	1.39089	1600	1.56014	4500	1.77851	7400	1.91154	13000	2.03855
210	1.07237	500	1.28445	790	1.39391	1700	1.57416	4600	1.80352	7500	1.91458	14000	2.05518
220	1.08390	510	1.28923	800	1.39690	1800	1.58747	4700	1.80875	7600	1.91757	15000	2.07065
230	1.09489	520	1.29391	810	1.39985	1900	1.60004	4800	1.81321	7700	1.92052	16000	2.08512
240	1.10542	530	1.29851	820	1.40277	2000	1.61195	4900	1.81790	7800	1.92344	17000	2.09869
250	1.11553	540	1.30300	830	1.40564	2100	1.62325	5000	1.82249	7900	1.92632	18000	2.11148
260	1.12523	550	1.30740	840	1.40678	2200	1.63403	5100	1.82699	8000	1.92916	19000	2.12357
270	1.13453	560	1.31172	850	1.41128	2300	1.64432	5200	1.83142	8100	1.93197	20000	2.13503
280	1.14345	570	1.31597	860	1.41408	2400	1.65414	5300	1.83575	8200	1.93475	21000	2.14594
290	1.15204	580	1.32015	870	1.41683	2500	1.66358	5400	1.84002	8300	1.93749	22000	2.15633
300	1.16035	590	1.32426	880	1.41953	2600	1.67261	5500	1.84421	8400	1.94020	23000	2.16624
310	1.16838	600	1.32830	890	1.42220	2700	1.68133	5600	1.84833	8500	1.94551	24000	2.17573

Canal

The use of these Tables may be illustrated by the following examples, taken from the Encyclopedia Britannica, in the articles *River*, and *Water*, from which we have taken in a great measure the present article.

(1) Water is brought into the city of Edinburgh in several mains, one of which is a pipe of five inches in diameter; its length is 14637 feet, and the reservoir at Comiston is 44 feet higher than the reservoir into which it delivers the water at Castle-hill: what is the number of Scotch pints it should deliver in a minute?

First, we have $d = \frac{5}{4} = 1.25$ inches, the log. to which is 2.49472.

Seondly, we have $s = \frac{14637}{44} = 332.7$, whose log. is 1.18533.

$$\begin{array}{r} 2.49472 \\ 1.18533 \\ \hline 1.30939 \end{array}$$

which is the log. of 20.385 inches. In the third column of Table I. opposite to $d = 1.2$ and $d = 1.3$ are 3, and .31, of which the mean is .305 inches, the correction for viscidity.

Therefore, the velocity in inches per second $= 20.385 - .305 = 20.08$.

To obtain the Scotch pints per minute, (each containing 103.4 cubic inches,) multiply the velocity by 60, and this product by 5^2, and this by .7854 (the area of a circle whose diameter is 1) and divide by 103.4. This operation, performed by logarithms, is—

$$\begin{array}{lr} \log.\ 20.08 = \text{———} & 1.30276 \\ \log.\ 60'' = \text{———} & 1.77815 \\ \log.\ 5^2 = \text{———} & 1.39794 \\ \log.\ .7854 = \text{———} & 9.89509 \\ \hline & 4.37394 \\ & 2.01451 \\ \log.\ 103.4 = \text{———} & 2.35943 \end{array}$$

which is the log. of 228. 8 pints.

(2) A canal is 18 feet broad at the surface, and seven feet at the bottom; it is four feet deep, and has a declivity of four inches in a mile: what is its mean velocity?

The slope of the canals corresponding to four feet deep, and $5\frac{1}{4}$ projection, is 6.8 feet, therefore the border touched by the water is $6.8 + 7 + 6.8 = 20.6$. The area $= 3 \times \frac{18+7}{2} = 50$ square feet.

Therefore $d = \frac{50}{20.6} = 2.427$ feet, or 29.124 inches. The log. corresponding to this in Table I. is 3.21113, and the correction for viscidity from the third column of the same table is 1.58. The slope is $\frac{1}{3}$ of a foot in a mile, or one foot in 3 miles; therefore $s = 15.84$, whose log. $= 2.08280$.

$$\begin{array}{r} 3.21113 \\ 2.08280 \\ \hline 1.12833 \end{array}$$

which is the log. of 13,438 inches,

$$\begin{array}{r} 13.438 \\ 1.58 \\ \hline 11.858 \end{array}$$

$11.858 =$ the velocity per second.—For further information on this subject, the reader is referred to the articles of the Ency. Brit. before mentioned.

Water, power of, when stopped by obstructions, see *Obstructions*.

Water-Table, a string-course moulding, or other projection, placed to carry off water.

Ways, (*waeg*, Sax.) It is very uncertain which nation of antiquity first established military ways. The Persians seem to have constructed them at a very remote period. According to Isidore, the Carthaginians were the first who paved their public ways. Ancient authors do not furnish us with many data, whereby we might judge of the degree of care bestowed on their roads by the

Grecian states. Herodotus simply says, that, among the Lacedæmonians, the management of their ways was wholly invested in their kings. Strabo says, that the Greeks neglected three objects to which the Romans paid an especial attention — the cloacæ, or common sewers; the aqueducts; and the public ways. See, for further particulars, the articles *Road*, *Pavement*, &c. The *curator viarum*, or overseer of the ways, was an officer of great dignity among the Romans. Julius Cæsar was the first person of high-rank among them, who accepted the situation of curator of the public ways, which was afterwards rarely ever conferred, except upon those who were of consular dignity. Thernus, a noble Roman, according to Cicero, served this office, and became curator of the Flaminian way, and was a colleague of Cæsar's. Pliny says, in a letter to Pontius, that the news of Cornutus Tertullus having accepted the surveyorship of the Æmilian way affected him with great joy; and Statius also, in his Sylvæ, mentions among his eulogiums on Victorius Marcellus, who was of the prætorian order, that he had been selected by the emperor Domitian to be surveyor of the *via Latina*.

"Quique tuos alio subtexit munere fasces;
Et spatia antiquæ mandat renovare Latinæ."

He also mentions, as a mark of singular dignity, that Plotius Grippus, whom he calls *majoris gradus juvenem*, had been trusted, by the same emperor, with two of the most honourable offices of the empire, *præfectum annonæ et curatorem viarum*, lib. iv. Sylvarum, in ritu Saturnalitio ad Plotinum.

Water-shoot, a wooden trough for discharging rain-water from a building.

Weather-boarding, boards lapped over each other, to prevent rain &c. from passing through.

Weather-tiling, covering a wall, or vertical surface, with tiles.

Weepers, small sepulchral statues in old monuments.

Weights and Measures. Of weights and measures there are various kinds, as they are used for different things, or in different countries: in this article we shall give only such as more particularly concern architects and builders. Of measures, those which belong to our subject, are such as are used in calculating length, superficies, or solidity. The measures of length are as follows:—

Scripture Long Measures.

	ENGLISH	
	ft.	in.
Digit		.912
Palm = 4 digits		3.648
Span = 3 palms		10.944
Cubit = 2 spans	1	9.888
Fathom = 4 cubits	7	3.552
Ezekiel's reed = 1½ fath.	10	11.328
Arabian pole = 2 fathom	14	7.104
Schoenus = 20 fathom	145	1.104

Another *span*, used in the East, was equal to one-fourth of a cubit.

Grecian Long Measures.

	ENGLISH		
	paces.	ft.	inch.
Dactylus (digit)			.7554
Doron, dochme, palista = 4 dactyli			3.0219
Lichas = 10 dactyli....			7.5547
Orthodoron = 11 dactyli			8.3102
Spithame = 12 dactyli ..			9.0656
Pous (foot) = 16 dactyli		1	.0875
Pygme (cubit) = 18 dact.		1	1.5984
Pygon = 20 dactyli....		1	3.109
Pecus (larger cubit) = 24 dactyli		1	6.1312
Orgya (pace) = 4 pecus		6	.525
Stadium = 100 orgyæ	100	4	4.5
Millium (mile) = 8 stad.	805	5	

In Greece there were used two kinds of long measure, the *Olympic* and the *Pythic*: the former in

Peleponnesus, Attica, Sicily, and the Grecian colonies in Italy; the latter in Thessaly, Illyria, Phocis, Thrace, and Marseilles in Gallia. The Olympic foot, properly called Greek, contained,

	English inches.
According to Dr. Hutton	12.108
——— Folkes	12.072
——— Cavallo	12.084

The Pythic foot contained,

	English inches.
According to Hutton	9.768
——— Paucton	9.781

Hence it appears, that the Olympic stadium is 201½ English yards nearly; and the Pythic or Delphic stadium, 162¾ English yards nearly. The Macedonian foot was 13.92 English inches, and the Sicilian foot of Archimedes 8.76 English inches.

Jewish Long or Itinerary Measures.

	ENGLISH		
	miles.	pac.	ft. dec.
Cubit			1.824
Stadium = 400 cubits ..		145	4.6
Sabbath-day's journey = 5 stadia		729	3
Eastern mile = 10 stad.	1	403	1
Parasang = 3 miles ...	4	153	3
Day's journey = 24 miles	33	172	4

Roman Long Measures.

	ENGLISH		
	paces.	ft.	inch.
Digitus transversus			.726
Uncia (inch)			.967
Palma minor = 3 unciæ .			2.901
Pes (foot) = 12 unciæ .			11.604
Palmipes = 15 unciæ ..		1	2.505
Cubitus = 1½ pes		1	5.406
Gradus = 2½ pedes....		2	5.01
Passus = 2 gradus		4	10.02
Stadium = 625 pedes ..	120	4	4.5
Milliare = 1000 passus	967		

The smaller Roman measures were,

6 scrupula = 1 sicilicum.
8 scrupula = 1 duellum.
1½ duellum = 1 seminaria.
18 scrupula = 1 digitus.

Two passus were equivalent to one *decempeda*.

The length of the Roman foot in English inches is stated as follows,

By Bernard...............	11.640
Picard and Hutton......	11.604
Folkes	11.592
Raper (before Titus)....	11.640
—— (after Titus)	11.580
Schuckburgh (from rules)	11.6064
——— (from buildings)	11.6172
———(from a tombstone)	11.6352

Hence 11.6 English inches seems to be a medium, and therefore the Roman mile = 1611 English yards, being 149 yards less than the English mile. See *Hecatompedon*.

The following are a collection of ancient measures, taken from Folkes, Schuckburgh, Hutton, Raper, Cavallo, &c. reduced to English.

Arabian foot	1.095	H.
Babylonian foot	1.144	H.
	1.135	H.
Drusian foot	1.090	H.
Egyptian foot	1.421	H.
Egyptian stadium....	730.8	
Greek foot	1.009	H.
	1.006	F.
	1.007	F.
	1.007	C.
Greek Phyleterian foot	1.167	H.
Hebrew foot.........	1.212	H.
Hebrew cubit	1.817	H.
Hebrew sacred cubit .	2.002	H.

Hebrew great cubit = 6 common cubits, H.
Ptolemaic foot = Greek foot, H.

Greek Superficial Measures.

Olympic Land Measure.

36 Olympic square feet = 1 Hexapodon.
6 Hexapoda = 1 Hemihectos.
2 Hemihecti = 1 Hectos, or Modius.
6 Modii = 1 Medimnus, or Jugerum.

Hence it appears that the Olympic jugerum was equal to 103 English perches, or nearly five-eighths of an acre.

Pythic Land Measure.

1666⅔ square cubits = 1 Hemihecton.
2 Hemihecti = 1 Medius.
6 Modii = 1 Medimnus, or jugerum.

The Pythic jugerum, therefore, appears to have been equal to 109

English perches, or nearly eleven-sixteenth of an acre.

The *plethron*, or acre, is said by some to contain 1444, by others 10,000 square feet; the *aroura* was half of the plethron. The aroura of the Egyptians was the square of 100 cubits.

Roman Land Measures.

100 square Roman feet = 1 scrupulum.
4 scrupula = 1 sextulus.
1½ sextulus = 1 actus.
6 sextuli, or 5 actus = 1 uncia.
6 unciæ = 1 square actus.
2 square actus = 1 jugerum.
2 jugera = 1 heredium.
100 heredia = 1 centuria.

The actus was a slip of ground four Roman feet broad and 120 long. The jugerum, or acre, was considered as an integer, and divided, like the libra, or as, in the following manner:—

	unciæ.
1 as	12 as.
$\frac{11}{12}$ deunx	11 deunx.
$\frac{5}{6}$ dextans	10 dextans.
$\frac{3}{4}$ dodrans	9 dodrans
$\frac{2}{3}$ bes	8 bes.
$\frac{7}{12}$ septunx	7 septunx.
$\frac{1}{2}$ semis	6 semis.
$\frac{5}{12}$ quincunx	5 quincunx.
$\frac{1}{3}$ triens	4 triens.
$\frac{1}{4}$ quadrans	3 quadrans.
$\frac{1}{6}$ sextans	2 sextans.
$\frac{1}{12}$ uncia	1 uncia.

If we take the Roman foot at 11.6 English inches, the Roman jugerum was 5980 English square yards = 1 acre, 37½ perches. See *Foot.*

English Measures.

By the late act relating to weights and measures, in the first and second clauses, it is enacted, that the old standard yard of 1760, in the custody of the clerk of the house of commons, shall continue to be the standard unit of extension, or lineal, superficial, and solid measures, when the temperature is at 62° of Fahrenheit's thermometer. In the third clause, it is enacted, that if the standard yard should be lost or injured, it is to be restored by a reference to the length of the pendulum, vibrating seconds in the latitude of London, at the level of the sea, and in vacuo. This length has been found, and is by the act declared to be, 39.1393 inches. Hence the length of the yard to that of the pendulum, is in the proportion of thirty-six inches to 39.1393 inches, or of the number 360,000 to the number 391,393; so that if the length of the pendulum be divided into 391.393 equal parts, then will 10,000 of these parts be the length of an inch, according to the imperial standard.

Long Measure.

	pendulums.
1 inch = $\frac{1}{80.1393}$ of pendulums	.02555
1 foot = 12 inches	.306597
1 yard = 3 feet	.919792
1 pole or perch = 5½ yards ..	5.058854
1 furlong = 40 poles	202.354156
1 mile = 8 furl. = 1760 yds.	1618.833244

The English land chain = 22 yards.
a link = 7.92 inches.
A palm = 3 inches.
A span = 9 inches.
A cubit = 18 inches.
A pace = 5 feet.
A fathom = 2 yards.

Square Measure.

	square pendulums.
1 inch = $\frac{1}{1531.8288}$ of sq. pend.	.000653
1 foot = 144 inches	.094002
1 yard = 9 feet	.846017
1 pole = 30¼ yards	25.592008
1 rood = 40 poles	1023.680107
1 acre = 4 roods.	4094.720426

The square chain = 484 square yards.
An acre = 10 square chains.

Cubic Measure.

	cubic pendulums.
1 inch = $\frac{1}{59956.8989}$	.0000176
1 foot = 1728 inches	.0238207
1 yard = 27 feet	.7781587

French Measures.

(1) According to the *old system*, previous to the revolution.

		English inches.		
A point	=	.0148025	=	1/68 nearly.
A line	=	.088815	=	1/11 nearly.
An inch (pouce)	=	1.06578	=	16/15 nearly.
A foot	=	12.78933		
An ell (aune)	=	46.8947	=	44 Fr. in.
A sonde	=	63.9967	=	5 Fr. ft.
A toise or fath.	=	76.736	=	6 Fr. ft.
A perche	=	230.208	=	18 Fr. ft.
A perch (*mesure royale*)			=	22 Fr. ft.
A square inch	=	1.13582		Eng. sq. in.
An arpent	=	about ⅚ acre English.		
An arpent (*mesure royale*)	=	abt. ¼ Eng. ac.		
A cubic inch	=	1.21063		Eng. cub. in.
A litron	=	65.34		

(2) According to the new system.

Measures of Length.

		English miles.
Millimetre	=	.03937
Centimetre	=	.39371
Decimetre	=	3.9371
Metre	=	39.371
Decametre	=	393.71
Hecatometre	=	3937.1
Chiliometre	=	39371.
Myriometre	=	393710. or 6 miles, [1 furlong, 156 yds. 6 in.

An inch is .0254 metres.
2441 inches is 62 metres.
1000 feet is 305 metres nearly.

Square Measure.

		sq. yds. English.	
Are (sq. decametre)	=	119.6046	= 3.95 {perches.
Decare	=	1196.046	
Hectare	=	11960.46	

Solid Measure.

		cubic feet.
Decistere............	=	3.5317
Stere (a cubic metre)	=	35.317
Decastere	=	353.17

In order to express decimal proportions in this system, the following terms have been adopted:—

Deca	prefixed denotes	10 times.
Heca	———————	100 times.
Chilo	———————	1000 times.
Myrio	———————	10000 times.
Deci	expresses the	10th part.
Centi	———————	100dth part.

English Avoirdupois Weight, (new Standard.)

					Cubic in. of water.		New gal. of water.
27 11/32	grains	=	1 dram	=	.10831015625	=	1/2560
16	drams	=	1 ounce	=	1.7329625	=	1/160
16	ounces	=	1 pound	=	27.7274	=	1/10
28	pounds	=	1 qr. cwt.	=	776.3672	=	2⅘
4	quarters	=	1 cwt.	=	3105.4688	=	11⅕
20	cwt.	=	1 ton.	=	6210.9376	=	224

The following TABLE (from Rees's Cyclopedia) shews the comparative Weight of Bodies on different Parts of the Earth's Surface, with the proportional Lengths of the Second's Pendulum, as also its daily Number of Vibrations in each Latitude, supposing it correct at Greenwich Observatory, that is, vibrating 86400 Seconds in 24 Hours.

	Latitude.			Weight of 100 lbs.	Length of pendulum English inches.	Number of vibrations.
	°	′	″			
	0	0	0	100.0000	39.0083	86256.3
	5	0	0	100.0042	39.0090	86258.1
	10	0	0	100.0165	39.0147	86263.4
	15	0	0	100.0366	39.0226	86272
	20	0	0	100.0637	39.0331	86284
	25	0	0	100.0973	39.0462	86298.3
	30	0	0	100.1362	39.0614	86315
	35	0	0	100.1793	39.0782	86333.6
	41	0	0	100.2251	39.0961	86353.3
	45	0	0	100.2724	39.1145	86373.7
PARIS OBSERVATORY . . .	48	50	14	100.3088	39.1287	86389.4
	50	0	0	100.3198	39.1330	86394.1
GREENWICH	51	28	40	100.3335	39.1383	86400
ST. PAUL'S, LONDON . . .	51	30	49	100.3338	39.1385	86400.2
	55	0	0	100.3656	39.1509	86413.8
	60	0	0	100.4087	39.1677	86432.4
	65	0	0	100.4476	39.1829	86449.1
	70	0	0	100.4812	39.1960	86463.5
	75	0	0	100.5083	39.2065	86475.2
	80	0	0	100.5284	39.2144	86483.9
	85	0	0	100.5407	39.2192	86489.2
	90	0	0	100.5449	39.2208	86491

Weir. A *weir* or *bar* is a dam erected across a river, for the purpose of ~~raising its waters, either~~ in order to take off a draft for a mill, or to deepen the channel. A weir consists of a dam of solid masonry, or built of timber, properly fortified with shores and banks: on the top is set up a strong plank, called the *waster*, *voider*, or *offset*, over which the water flows, and which is brought to an accurate level. Such voiders are frequently made in the side of a mill-course for the purpose of letting the superfluous water run off. In the weirs represented in plate M. 17. *figs.* 3, 4. the latter of which is the usual form, FR is the wasteboard or *waster*.

The theory of the discharge of water over a weir, is comprised in the following proposition. "Given the length of an offset made in the face of a reservoir of stagnant water, and the depth of its lip under the horizontal surface of the water, to determine the discharge, or the quantity of water which will run over in a second." Let AB be the horizontal surface of the still water, and F the lip of the waster; call the depth BF under the surface *h*, and the length of the waster *l*. The water is supposed to flow over into another basin or channel, so much lower, that the surface HL of the water is lower, or at least not higher than F. If the water could be supported at the height BF, BF might be considered as an orifice in the side of a vessel, in which case the discharge would be the same as if the whole water were flowing with the velocity acquired from the height ½ BF, or ½ *h*. And if we suppose that there is no contraction of the orifice, the mean velocity would be $\sqrt{2g\,\frac{1}{2}h} = \sqrt{772\,\frac{1}{2}h}$, in English inches, per second. The area of this orifice is $l\,h$, therefore, the discharge would be $l\,h\sqrt{772\frac{1}{2}h}$. This is the old theory, but is not an exact representation of the manner ~~in which the efflux really~~ happens. The water cannot remain at the height BF, but, in drawing towards the waster from all sides, it forms a convex surface AIH, so that the point I, where the vertical drawn from the edge of the waster meets the curve, is considerably lower than B. But as all the mass above F is supposed to be perfectly fluid, the pressure of the incumbent water is propagated, according to M. de Buat's opinion, to the filament passing over at F, without any diminution. The same may be said of any filament between F and I. Each tends, therefore, to move in the same manner, if it were really impelled through an orifice in its place. Therefore, the motions through every part of the line or plane IF, are the same as if the water were escaping through an orifice IF, made by a sluice let down on the water, and keeping up the water of the reservoir to the level AB. There is no doubt, M. de Buat observes, that the height IF must depend on the whole height BF, and that there must be a certain determined proportion between them. From his own experiments he concludes, that this proportion is that of one to two, or that IF is always one half of BF.

The foregoing is the reasoning adopted by M. de Buat, but some parts of it have been objected to by other writers. However, on the whole, his results are tolerably accurate, and we may adopt, as a good approximation to the truth, the formula he gives for the value of the discharge (D).

$D = .431 \times (\sqrt{2G} \,.\, h\tfrac{3}{2} \times l)$. If we substitute 26.49 for $\sqrt{2G}$, or the velocity with which a head of water of one inch will impel the water over a weir, and multiply this by .431, we get 11.4172, or 11⅓ (nearly) of cubic inches discharged per second over every inch of a waster, when the edge of it is one inch below the surface of the reservoir, and this must be multiplied by $h^{\frac{3}{2}}$, or by the cube of the square root of the head of water. Thus, suppose the edge of the wasteboard to be four inches below the surface; the root of this is 2, whose cube is 8; therefore, a waster of this depth under the surface, and three feet long, will discharge every second 8 × 36 × 11⅓ cubic inches of water, or $\frac{1}{15}$ cubic feet. The following are the results of some of M. de Buat's experiments, and will show how much this calculation may be depended upon. The greatest error is in the first, and must be attributed to a much smaller lateral contraction under so small a head fo water.

Depth of edge of water.	Discharge found by theory.	Discharge actually observed.	Cub. inch. discharg'd per second by each inch of the waster.
1.778	506	524	28.98
3.199	1222	1218	69.83
4.665	2153	2155	123.03
6.753	3750	3771	214.20

The board was 18⅓ inches long. It may be observed, that IF depended very much on the form of the wasteboard; when it was a very thin board of considerable depth, IF was much greater than when the board was thick, or narrow, and set on the top of a broad dam-head, as in *fig.* 4. We may give the formula a form that will correspond to any ratio which experience may discover between BF and IF, by making $BI = \frac{m}{n} BF$; then we have for the formula

$$D = \frac{2}{3} l \sqrt{2G} \left\{ 1 - \left(\frac{m}{n}\right)^{\frac{3}{2}} \right\}^{\frac{3}{2}} h$$

In the following table, the first column contains the depth in English inches from the surface of the stagnant water in the reservoir to the edge of the waster, and the second the cubic feet of water discharged in a minute over every inch of the waster.

Depth.	*Discharge.*
1	.403
2	1.14
3	2.095
4	3.225
5	4.507
6	5.925
7	7.466
8	9.122
9	10.884
10	12.748
11	14.707
12	16.758
13	18.895
14	21.117
15	23.419
16	25.8
17	28.258
18	30.786

It has been observed, that, in making the experiment, a result has generally been obtained greater by about $\frac{1}{15}$ than that in this table, and, therefore, it is recommended to add $\frac{1}{15}$ to the result found by this table, which will give an answer very near the truth.

When D is known and *h* required, we have $h = \left(\frac{D}{11\frac{1}{3} l}\right)^{\frac{2}{3}}$ very nearly.

The next proposition of importance is this: "The discharge and section of a river being given, to determine how much the waters will be raised by a weir of the whole breadth of the river, discharging the water with a clear fall, that is the surface of the water in the lower channel being below the edge of the weir."

Here we have 2 G = 746 nearly, because there will be no contraction at the sides, when the weir is the whole breadth of the river: and the water which was before stagnant, is now moving with the velocity $\frac{D}{S}$, S being the section of the river. Let a = height of weir from the bottom of the river, and h = height of water above the edge of the weir. We shall find the velocity with which the water approaches the weir $= \frac{D}{l(a+h)}$, l being the length of the weir, or breadth of the river. Therefore, the height producing the primary mean velocity is $\left\{\frac{D}{l\sqrt{2g}(a+h)}\right\}^2$, and the equation for h becomes $h = \left\{\frac{D}{.431\, l\sqrt{2G}}\right\}^{\frac{2}{3}}$ when the water above the weir is stagnant; therefore, when it is already moving with the velocity $\frac{D}{l(a+h)}$, we shall have $h = \left\{\frac{D}{431\sqrt{2G}}\right\}^{\frac{2}{3}} - \left\{\frac{D}{l\sqrt{2g}(a+h)}\right\}^2$. This equation would be troublesome to solve in the regular way, because the unknown quantity h is found in the second term of the answer; but as we know that the height producing the velocity above the weir is very small in comparison with h and a, and, if only estimated roughly, will make a very insensible alteration in the value of h, and, by repeating the operation, we may correct this value, and obtain h to every degree of exactness.

Suppose, for instance, a river, the section of whose stream is 150 feet, discharges 174 cubic feet of water in a second: how much will the waters of this river be raised by a weir of the same width, and three feet high? Suppose the width to be 50 feet; this will give three feet for the depth, and we see that the water will have a clear fall, because the lower stream will be the same as before. The section being 150 feet, and the discharge 174, the mean velocity is $\frac{174}{150}$, or 1.16 feet = 14 inches nearly, which requires an height of $\frac{1}{4}$ of an inch very nearly. Therefore $h = \left\{\frac{D}{.431\sqrt{2G}\, l}\right\}^{\frac{2}{3}} - \frac{1}{4}$. Now $\sqrt{2G}$ is in the present case = 27.313, l = 600, and D = 174 x 1728 = 300.672. Therefore h = 12.192 — 0.25 = 11.942. Now, correct this value of h, by correcting the second term, which is $\frac{1}{4}$ of an inch, instead of $\left\{\frac{D}{\sqrt{2G}\, l(a+h)}\right\}^2$ or .141. Then we get h = 12.192 — .141 = 12.051, which is a sufficiently near approximation. Thus we see, that a weir, which dams up the whole of the former current of three feet deep, will only raise the water of this river one foot. The same rule serves to show how high we ought to raise this weir, to produce any given rise in the waters.

The following table exhibits a comparison of some results found by this rule with those found by experience, (in inches.)

Discharge of the weir per second.	Head producing the velocity at the weir.	Head producing the velocity above it.	Calculated height of the river above the waster.	Observed height.
3888	7.302	.625	6.677	6.583
2462	5.385	.35	5.035	4.75
1112	3.171	.116	3.085	3.166
259	1.201	.0114	1.189	1.250

As to their contraction, weirs are made in different ways, as of timber alone, sometimes of bricks, or stones, and timber, and of different other materials; they have commonly from two to eight or ten openings to let the water pass through, according as the breadth of the stream and other circumstances may require. In slow-moving waters, strong wooden beams thrown across the stream, and made close by means of boards well secured, are in many cases sufficient. In a small river, a weir may consist of several rows of stakes, firmly driven down, intertwined with branches of trees, and the intervals filled with stones. But for more powerful rivers, the weirs must be of stronger construction. They may consist of strong frameworks of wood, having the different compartments all paved with large stones; they must rise very gradually against the stream, and be made to slope gradually away before it, as it flows over. In Rees's Encyclopedia, we have the following account of a weir constructed under the direction of the Rev. W. H. Coham, in Devonshire.

"In this weir, which was formed on a large, rapid, and strong river, after the stream had been temporarily diverted, and every thing removed for a proper foundation, a double row of pits was dug into a rocky substratum, directly across the bottom or bed of the river, at about five feet asunder lengthways, by four feet in breadth, and about two feet in depth; and into these pits, oak posts of about six or seven inches square were fixed. The mason then raised a perpendicular wall, without any cement, about five feet and a half thick, entirely enclosing the posts, the labourers being employed in the mean time in *backing up* the wall on the higher side with some of the *stiffest* clay to be had. This was, however, afterwards found to be wrong; it should have been done in the *puddle* manner, by means of mould and gravelly earth.

"When the wall was raised to such a height as was deemed necessary, in relation to the level required, and the preservation of the lands adjacent, the upper parts of the oak-posts were sawn off, in order to receive cross-pieces and joists, the front posts being then left to stand about six inches higher than the hinder ones; and on these joists oak planks were pinned, about six feet and a half long, by three inches thick. These planks were brought forwards to project about one foot and a half over the perpendicular of the wall, on the lower side, forming a sort of lip, as it has been termed; the clay, together with these planks, constituting an inclined plane, and terminating at the distance of about fifteen feet up the stream, on the common bed of the river.

"The entrance for the *leat* was cut at about thirty feet above the *lip* of the weir, where, to regulate the quantity of water to be admitted, three strong flood-hatches, to be lifted or let down by a lever and windlass, were placed; and through which a column of water, of about eight feet in width, by four feet in depth, may be introduced at any time. Between the *leat* and the river, a stone wall, strongly cemented, is erected, which is about eight feet in height, and carried from the head of the leat to about thirty feet below the weir, in a parallel line with the river, and at the end of which wall another flood-hatch is fixed on a level with the bed of the river. This latter hatch will always be of great advantage when any reparations may be wanted on the weir; as on drawing it up when the water is low, the weir in a few hours will be left perfectly dry, and the workmen, with the greatest conveniency may proceed in their operations. From the top of the side wall, above the weir, the ground is made sloping to the river, and below it is covered with turf, and levelled as a foot path.

"Immediately below the weir, in this case, there is an outlet regulated by another floodhatch, and conducted through a *shoot* formed of oak plank, from the *leat*, and contrived for the admission of salmon, which are there sometimes taken; and below the lower floodhatch, a trap, or *willey*, as it is there termed, is made for the catching of smaller fish: this part of the work does not, however, properly belong to this kind of weir, therefore it need not be more noticed.

"The height of the weir is about four feet above the level of the river where it is fixed; and its length, from bank to bank, directly across, or at right angles with the stream, is about forty-eight feet; forty feet of which is carried at a perfect level, and over which the water falls precisely at the same depth, forming a beautiful cascade. The remaining portions of the length of the weir, namely, four feet on each side, are raised, gradually ascending to the banks, for the purpose of warding off the torrent from them in time of floods, when the river, in this case, is very tumultuous.

"The lip part of the weir is found to answer perfectly; as in proportion to the force of the water behind, so is the distance which it is thrown over the weir from the foundation of the perpendicular wall.

"If the writer had not been foiled, and had part of the work to perform over again, in consequence of the use of clay, as already noticed, being under the necessity of driving on the weir in a direct line with the former work, into the side of the opposite bank as before; and after removing as much of the clay as could be got at, which will not unite completely with the soil, but become liable to be undermined by the water, by making a *puddle*, as used in canals of mould and gravel, in its stead, which succeeded in a complete manner; the whole cost of the weir would not have exceeded £75.

"This weir or wear, from its present appearances, may now, it is said, seem to bid defiance to time; and be safely recommended as a pattern to those who may have occasion to construct any thing of a similar kind, either for watering land, for machinery, or other uses."

For further information on this subject, the reader may consult Dr. Anderson's "Treatise on the Erection of Weirs, &c."

Well, a deep circular pit, or sort of shaft, sunk by digging down through the different strata, or beds of earthy and other materials of the soil, so as to form an excavation for the purpose of containing the water of some spring, or internal reservoir, by which it may be supplied.

It is customary to have wells built round with stone, or brick, from the bottom to the top; and pumps are frequently fixed in them. There are two methods of building the stone, or brick, within the well, which is called the *steining*. By one of these methods, a circular ring is first formed, whose diameter is the same as that of the intended well; this ring is composed of timber, which is the same size as the brick-courses with which the well is to be lined. The lower edge of this circular ring is made sharp, and is shod with iron, so that it may have a tendency to cut into the ground; and it is then placed flat upon the ground, and the bricks are built upon it to a considerable height, in the manner of a circular wall. The well-digger next gets within this wall, and begins to dig away the earth at the bottom, and the weight of the wall forces the circular ring, or kirb, and with it the brick-work with which it is loaded, to descend into the earth, and it continues to sink as fast as the earth is removed. When this brick or stone work is sunk a considerable depth, the building may be continued, and more added to the top, and the wall may thus be raised at top, as fast as the kirb sinks. When, however, it gets very deep, and particularly if it pass through a soft strata, it will sink no longer; and when this is the case, a second kirb of a smaller size is sometimes commenced within the first. When, owing to the softness of the strata, a kirb will not sink, or when it is required to stop out water, the bricks, or stones must be laid, one by one, at the bottom of the work, taking care that the work is not left so unsupported as to allow the bricks to fall as they are laid: this process is termed *under-pruning*.

The process of *digging* wells is chiefly performed by means of a small short-handled spade, and a small implement resembling a pick-axe, the earth being drawn up in buckets by the hand, or a windlass fixed over the opening for the purpose. The following ingenious mode of digging a well has been proposed by a French philosopher, who advised that the ground should be perforated to a sufficient depth by means of an auger, or borer: a cylindrical wooden pipe being then placed in the hole, and driven downward with a mallet, and the boring continued, that the pipe may be forced down to a greater depth, that it may reach the water, or spring. In proportion as the borer becomes filled with earth, it must be drawn up and cleansed; and by the continual addition of fresh pieces of pipe, the boring may be carried to a considerable extent under-ground, and water may, in the greatest number of cases, be reached by means of this process. Wells, it is added, constructed in this manner, are superior to those which are formed according to the common method, both in point of cheapness, and likewise because they afford a more copious, and also a more certain, supply of water; however, it must be observed, that to bore to any considerable depth in this manner, would require a large and expensive boring instrument; it would also, when worked deep, require a great power at the top to bore, and it might be entirely stopped by the nature of the strata which it had to bore through. However, in some cases it might answer; and it would in those cases, from its readiness, be extremely convenient. But by far the best mode would be to have metallic pipes cast on purpose, so formed as to fit exactly upon each other, to any depth that might be requisite; as the wooden pipes, from the difficulty that would be found in driving them down, and making them fit so nicely as to admit the borer, would be frequently a great obstruction to the work.

With regard to the strata for digging, we may observe, that when differently formed strata of sand, to a considerable depth, rest upon beds of clay, and have a free issue at the lowest ends of them, if wells were sunk into the sand beds higher up, no water can be there permanently found, till the strata of sand be completely penetrated through, and till we have gone to some depth into the beds of clay that are below them. The water would never rise, in such cases, much higher than a certain point in the wells; for, as soon as it rose to the porous sand, it would immediately flow through it, and would thus make its escape below. If the streams that run beneath the beds of sand be small, and the draught of water at any time from the well be particularly large, the well may be so much sunk as to be made nearly dry, and will require some time to fill again, which will cause great inconvenience; this can only be obviated by making the wells very wide, and by sinking them very deep into the clay strata.

As springs, from which wells are supplied, are formed by water percolating through the upper strata of the earth, and descending downwards until it meets with a stratum of clay, or other impervious material which intercepts its course, it may naturally be concluded that an abundant spring for this use need never be expected in places that are covered to a great depth with sand, without any stratum of clay to force the water upwards; nor can we expect abundant springs in cases where the soil consists of a uniform bed of clay, that continues to a great depth from the surface; for, to flow in abundance, the water must always have a porous stratum; and it can be made to flow horizontally in that only, when it is supported by a stratum of some substance, as clay, which is impermeable to water. Hence we have as a rule, that wells, if begun with sand, or gravel, or any rich strata, will very seldom be supplied with water, until they have arrived at clay; and that, if they commence with clay, no water can be hoped for in abundance, till they have come to sand, gravel, or some kind of porous rock.

As facts are the support and illustration of theory, and as they frequently shew circumstances better than theory can exhibit them, the following examples of the process and effects observed in digging wells have been collected, principally from the Report on Agriculture, and other works of a similar nature.

A well was sunk in 1794, at Norland House, on the road to Uxbridge, to the depth of two hundred and thirty-six feet; and after this a hole of five inches and a quarter was bored down, and a copper pipe, whose diameter was the same as that of the borer, was driven down to the additional depth of twenty-four feet, into a stratum of sand which was filled with water, and a mixture of sand and water instantly rushed up through the pipe so abundantly, that in eleven minutes it had risen to the height of one hundred and twenty-four feet; that is, one hundred feet in the well part, and twenty-four in the pipe; and in the course of one hour and nine minutes, it rose one hundred and nineteen feet more, that is, on the whole, two hundred and forty-three feet in one hour and twenty minutes. On letting down a sounding-line, it was discovered, that sand had arisen in such quantity as to fill the well to the height of ninety-six feet, which, by repeatedly digging out, was at last so considerably reduced, as to permit the water to rise through it more freely, until it flowed over the top of the well at the rate of forty-six gallons per minute; and if quantity had been requisite, it is said, that by clearing out the sand till the obstruction it afforded were of small consequence, it might certainly have been obtained after the rate of several hundred gallons per minute. However, quality was what, in this instance, was most requisite, and the water, by filtering through the great body of sand that was left at the bottom of the well in its ascent, was rendered very pure.

At Mr. Munday's brewery, at Chelsea, in 1793, a well was dug to the depth of three hundred and ninety-four feet, within twenty or thirty feet of the edge of the river, chiefly through a stratum of blue clay, or marl. At about the depth of fifty feet, they discovered a quantity of loose coal, twelve inches thick, and about the same depth was discovered a little sand and gravel. The well-digger, generally as he went on, bored from ten to twenty feet at a time below his work, and on the last boring, when the rod was about fifteen feet below the bottom of the well, he distinctly felt a rolling motion: on continuing to bore, the water gushed out with great force by the side of the auger; and he had scarcely time hastily to withdraw his boring instrument, put it with his other tools into the bucket, and be drawn up—as the water rapidly rose to the height of two hundred feet.

The following case happened in the vicinity of the metropolis. A gentleman bought a house and farm a little below Kensington gravel-pits, on the right-hand side of the road, nearly opposite to Holland House. The premises were entirely destitute of water, which appeared to the occupier to be so great an inconvenience, that he determined to try if he could find any there by sinking a well, even if he should be obliged to go to a very great depth. With this intent he commenced digging, and had got a great depth without finding any symptoms of water: at length, however, he did find water; and, to his surprise, (for he feared that, being so deep, it would require expensive works to raise it artificially,) it rose very quickly till it reached the top, when it ran over in a very copious stream, overflowing the field around it, till it found a level, and formed thus a rill that continued to flow at all times of the year.

The usual mode of clearing wells from noxious air, which sometimes fills them, is by means of a large pair of bellows and a long leathern pipe, which is suspended in the well, and fresh air, by means of the bellows, forced through it to the bottom of the well. The following apparatus, however, is recommended as being more efficacious, and equally convenient. Let six lengths of metal pipe, each eight feet long and two inches in diameter, be made of tin-plate, all except the upper one, which must be of copper, that it may bear the heat better: let a cylindrical vessel also be made of copper, large enough to hold about two gallons; and let it be fixed to the upper pipe, having through its sides a number of holes, for the admission of air to support a fire, which is to be kindled within it. This vessel must be so fixed, that it may have, at least, five feet of pipe above its top. To place this in the well, lower down the bottom length, the lengths being carefully fitted together and secured from any danger of drawing apart, and the joints rendered air-tight by the application of oil-putty. They must be let down until the bottom nearly touches the surface of the water, and the fire-pan may be supported on two timbers placed across the wall of the well. Fill the fire-coal with lighted charcoal, or wood, then, the copper pipe becoming heated, the internal air will be rarefied; and the external denser air continuing to press to

[illegible]

place, the noxious air will pass up the pipe as through a chimney, and the well will be thus cleared from it, and filled with pure air from above. The effect will be greater when the fire-pan is placed lower on the pipe; but it must not be placed too low, or the charcoal fire will produce carbonic gas in great abundance in the well.

WELL, the space occupied by a flight of stairs: the space left in the middle, beyond the ends of the steps, is called the *well-hole.*

WESTMINSTER ABBEY. The architecture and history of the abbey church of Westminster, so splendid and comparatively so perfect a monument of the architectural style and skill of our ancestors, deserves a more detailed account than the extent of our work will allow us to give to it. The site of the church and monastery of St. Peter was in early times an island, enclosed on the east by the main channel of the Thames, and on the west by a collateral branch. Its old name was Thorney, which some suppose to be given it from the Saxon *Thorn-eg*, an isle of brambles and thorns; and its situation is described in an authentic charter of Offa, as "Torneia in loco terribili ad Westminster." The monastery is said to have been founded by Sebert, the king of the East Saxons, one of the earliest converts to Christianity; but it owed its principal splendour to Edward the Confessor, who rebuilt the church and monastery in a magnificent style, and endowed them with ample revenues. Matthew Paris informs us, that "it was constructed in a new kind of arrangement, from which many persons, in erecting churches, took a pattern, and strove to imitate it." And Sir Christopher Wren gives the following descrip-script:—"The principal area, or nave, of the church being raised high, and vaulted with square and uniform ribs, is turned circular to the east. This on each side is strongly fortified with a double vaulting of the aisles in two stories, with their pillars and arches. The cross-building, contrived to contain the choir in the middle, and the better to support the lofty tower, rose with a plainer and lower vaulting; which tower then spreading with artificial winding stairs, was continued with plain walls to its timber roof, which was well covered with lead." Some have supposed that the novelty of this structure, mentioned by Matthew Paris, was the introduction of the form of a cross in the plan. While Laurence was abbot in 1163, in the reign of Henry II., the privilege of using the mitre, ring, and gloves, distinguishing marks of episcopal dignity, was obtained from pope Alexander III. and in the sequel the mitred abbots were allowed to sit in parliament, and enjoyed all the honours of bishops. In 1540, the abbey church was, by Henry VIII., constituted a cathedral, with a bishop, a dean, twelve prebendaries, &c. and Thomas Thirlby was made bishop of Westminster; afterwards the see was united, by Edward VI., to that of London; and by an act of his reign, it was declared to be still a cathedral. Mary restored the monastery to its pristine condition; but, in 1560, the monks were displaced, and the church again rendered collegiate, on a basis very similar to that which had been established by Henry VIII.

The building, in its present state, consists of a nave and two side-aisles, separated by ranges of tall, slender, clustered columns, supporting the roof, which is raised to a great elevation. The length of the whole edifice, within the walls, is three hundred and sixty feet, the breadth of the nave and aisles seventy-two feet, and the length of the cross, or transept, one hundred and ninety-five feet. On entering the great western door, the whole body of the church displays itself to view in a manner very striking; loftiness, lightness, and elegance, being its marking features; but these features are now much distracted by the numerous monuments which fill up the open spaces and cover the walls. The nave is separated from the choir by a screen; to the east of the choir is a chapel, raised to contain the shrine of Edward the Confessor, and raised considerably above the level of the pavement. At the east end is a sumptuous chantry, to the memory of Henry V. The north and south sides of the choir are occupied by aisles, and small chapels dedicated to different saints. In the reign of George II. many parts of the exterior of this church were coated over with stone, and otherwise repaired, at the public expense. The rich sculpture, however, and the statues which formerly adorned the buttresses, could not be restored; and these parts seem now ill suited to the highly ornamented building to which they are attached: and the two western towers, completed from the designs of Sir Christopher Wren, labour under a similar defect. The choir, in the form of a semioctagon, was surrounded by eight chapels; but, by the appropriation of the central chapel to be the porch of that of Henry VII., they are now reduced to seven. The cross-aisles, or transepts, have long been consecrated to the interment of distinguished personages. But the greatest architectural curiosity is the chapel of Henry VII., which is entered by a flight of steps leading to a magnificent gateway.

The chapel of Henry VII. was built by the monarch whose name it bears. According to Stow, he caused to be taken down the Virgin Mary's chapel, which was built by Henry III., and a tavern called the White Rose, both of which occupied the site of the present building. In the king's will, which is preserved at the Chapter-house at Westminster, and which is dated at Richmond on "the laste daie of the moneth of Marche," 1509, orders were given for the finishing this building, and for the erection of the tomb of the king. As some of the documents relating to these works will be considered curious to the architect, we shall give selections from them. With respect to the tomb, in the British Museum, among the Harleian MSS. is one bearing the title, "An estimate for the charge, for the making of a tomb for king Henry VII., which plott was afterwards disliked by king Henry VIII., and altered according as it now stands." In this are the following items:—

"Lawrence Ymber, Karuer,

"For makinge the patrones in timber, of different images, some of which were to be kneeling and some lying, lxiiij *li.*

"Memorandum. That Drawsword, *sherife* of York, saith, that the two images wh' ben lyenge in the tombe, and the kinges image wh' is kneelinge upon the tombe, yf he should make them as well as he can, he would deliver one of them redie wrought wh' xij weeks, wherefore he judgeth every peare of those three images redy wrought at lxvj *s.* viij. *d.* som is x *li.* &c. &c. Total som is xxxvj *li.*

"Humfray Walker, Founder.

"Item, the founder saithe, that

vj *m.* and iiij *c.* pound weight of fine yellow mettal, will perform the making of the images for the whole tomb, which ben in number, grete and small, xix—the price of every c of mettal, is xx *s.* Som is lxiiij *li.*

"His whole work to be delivered in one year and a half, at som totall vi *c.* iiij *li.*

"Nicholas Ewen, copper smithe and gilder.

"To finish his work in half a year, and receive cccx *li.*

"John Bell, John Maynard, paintors.

"For painting to be performed by iiij mens hands within three quarters of a year, xl *li.*

"Robart Vertue, Robart Jenins, and John Lebons, the kings iij mr masons,

"Say that the workmanship on the black *towch stone* and white marble for the tombe, after the maner of the moldings of the patrone wh' master Pageny hath made, will cost lxxx *li.* wh' will be deliv'd redy wrought within the space of one year, lxxx *li.*

"Mr. Finche and Roger Thorney, marchats.

"Say that 100 foote of blacke towche-stone is sufficient for the ligger and the base of the said tombe—price of ev'y foot in London, is ij *s.* Som x *li.* Item lxxx foote of whit marble will be sufficient for the sides and the ends of the said tombe, wh' will cost, to be deliv'd in London, as Mr. Ffinch saith, xiij *li.* vj *s.* viij *d.*

"Som totalis is m. cc. lvij *li.* vj *s.* viij *d.*

"Memorandum. That my lord of Darby hath an image made of copper 5 foote and half long, which weyed, when it was caste, and repaired redye to the gildinge, v c and a half weight:—for the casting and repairing of the same, the founder had lxxx *li.* Item, there went to the gildinge of the same image, xxxv *li.* Item, the gilder had for his labore, x *li.* Item, James Hales had for the making of the patron of the image in timber, c *s.*

"c xxx *li.*"

Torrysany, mentioned in the next document, is Torrigiano, of whom some particulars are related by Vasari, Cellini, Vertue, and Walpole. He was a competitor in the academy of Florence with Michael Angelo. He was engaged by Henry VIII. to erect the tomb of his predecessor; and it was the monarch's intention also to have one erected for himself and his queen by the same artist. The following indenture was copied by Britton from a MS. roll in the possession of the dean of Westminster, and contains several particulars interesting to the architect. The first part of the MS. is much torn, and consequently imperfect.

Agreement between the executors of king Henry VII. and Peter Torrysany.

" . . . . of our Lorde God M. D. XVI. and in the . . . . the xiij. Between the right Reverend fader in God . . . . Thomas Bisshop of Duresme, John Bisshop of Rochester, the right . . . . sourer of England, Charles erle of Worcester the Kings . . . . of the Kings Benche, Robert Reed Knyght Chiefe Justice . . . . owrer of the Kings Household, John Cutt Knyght vndir . . . . . . tament and last wille of the late King of most famous . . . . John Islepe Abbot of Westm^{r} on the *oon ptie*, and . . . . . . the *other ptie:* Witnesseth, that it is covenanted . . . . bitweene the said pties in maner and forme following.

"That is to say, the foresaid *Petir* covenanth promyttith and graunteth and hym and hys executors by thise pnts byndith to make and work or doo to be made and wrought wel clenly workmāly curiously and substancyally ffoure basements of blake marble square of the gretenesse every square oon foote half ...... in length oon foote of assise and in the same he shall sett iiij other basementts of white marble squared wyth levys and crests and upon the same iiij basements of white marble he shall set iiij pillours of copper gylt wrought with bases cuppes capitells and other garnysshmente and of heith gretenes and proporcyon according to the worke and upon the same iiij pillours of copp. gilt he shall set a creste of copp. gylt rounde aboute the worke squared wyth porcullies and fflowredelis and upon the same he shall make of white marble a vault wt archytraves and frese and creste with all ...... anships and colours thereunto belonging according as appereth by *the patren* and upon the said crests he shall sett iiij aungells of erthe bakid in an oven after the colour of white marble ev'y of them kneeling of the heith of ij foote of assise ffrom the knes upward of the whiche iiij aungells oon shall holde the pillour wt a cock upon the same all of copper gilt in the oon hand and the scourge of copp. gilt in the other hand another aungell shall holde the crosse of copp. gilt in oon hand and the iij nayles of copp. gilt in the other hande an othir aungell shall holde the sphere of copp. gilt in the oon hande and the hammer of copp. gilt in the othir hande and the iiijth aungell shall holde in oon hande a sphere staff with a sponge on the ende of copp. gilt and in the other hande the pynsons of copp. gylt and upon the same crests upon the former parte and the hynder parte he shall make the kings armes of white marbyll coloured as app'teynith wt the crowne Imp'rall ou' the same armes of copp. and gilt and at the right ende the armes of the late king and quene in a scochyn of white marble wt braunches and roses on either side of the same scochyn of white marble all coloured as appteynith and a crown Imprall of copp. gilt on the saide scochyn and at the other ende an other scochyn of white marble wt the Armes of England and Spayne and a branche of roses of white marble ou' either side all coloured as appteynith wyth a crowne Imperyall of copp. gilt on the saide scochin.——And all the saide garnysshment shall conteyne from the nether parte of the said iiij basements of blak marble unto the upper parts of the crests next the saide iiij Aungells ix foot of assise, and in length also ix foot of assise and also that under all the saide garnishment shall be made an awlter of the height of iij foote di' of assise and of length vj foote of assize and brede iij foote and iv ynches of assise and the basements of the same awlter shalbe made of blake marble and upon the same basements iiij square pillours of white marble with levys and crests with their proportions all coloured as app'teynith to the worke and under the saide awlter shalbe set xvj pillours of copper gilt wrought according to the saide patron and upon the saide pillours shalbe leyde and set a blake marble stone and under the same awlter shalbe leyde a bakyn ymage of erthe coloured of crist dede and upon the bakesyde of the saide awlter shalbe set a table of copp. gilt in length and brede after the proporcion of the worke and in the sides of the same table shalbe made ij historyes the oon of the resurreccion of oure Lorde ou' the foreparte all gilt and upon the bakesyde of the same table shall be made the hystory of the nativite of oure Lorde in lykewise gilt and at ev'y ende of the same table shall be set a square pyllour of copper gylt wrought wt levys bases and capitells according to the proporcion and height of the saide Awlter——And the forsaid Peter cov'nn'tith promyth th and g'nn'tyth by these p'nts that all the whyte marble aforsaid whiche shal be necessary for all the forsaid worke shalbe of oon p'fitt white coloure and that also all the saide blake marble requisyte to the said p'mysses shalbe in lykewyse of oon p'fite coloure. And all the copp. convenyent to the forsaid worke shalbe good pure fayre and clene copp. and that he the same Peter at hys owne propre costs and expensys shall fynde and bye aswel alma'n of white marble and blake marble as alman copp. and other things necessary and requysyte for the making fynyssbing and p'fyghting of the same Awlter and other the pmysses. And that all and all things necessary to the same——MOREOVER the said Peter cov'nn'tyth and gun'tyth by these p'nts that he the same Peter at hys owne propre costs and expensys shall wele surely puerly clerely sufficiently and workemanly gylde or do to be gylt with fynde golde all the forsaid copp. work in and aboute the forsaide Awlter and other p'mysses. And that all the forsaid blake marble and white marble necessary and requysite to all the forsaid worke shalbe grav'd and workmanly wrought according to the said patren. All the which basements Aungells Awlter and other the p'myssys above specifyed and to the same necessary as ys aforesaid the forsaid Peter covenn'tyth and gun'tyth by these p'sents fully to make ende and fynysh and the same at his owne propre costs clerely to set up wtin the new chapell which the forsaid late king caused to be made at Westm^r that is to say in suche place wtin the said chapell as by the forsaid lords and executours or any of them or their assignes shall be assigned before the first day of the moneth of Novembere the which shalbe in the yere of oure Lorde God M:V:XIX ffor all the whiche p'mysses togeder wt the workemanship fynysshing and setting up of the same and all othir the p'mysses the foresaid Peter knowlachith and confessith him by these p'nts to have receyved and had of the said lordes and executours beforehand at their sealyng of these endentures the some of Oon Thousand pounds st'ling—Of the which said Oon Thousand pounds the said Peter knowlachith and confessith hymself fully contentid paide and satisfied in full contenta con and payment of all the said Worke and thereof clerely acquytith and discharchith the same lordes and executors and the executors of them and euyhe of them by these p'nts—FFURTHERMORE this endenture witnessith that where' the said Peter and Benedyk Morovellj and hys feli'ship m'chaunts of Luka John Campua and John Baptist Morvellj also m'chaunts of Luka by their wryting obligatory bering date of the making herof be'n holde and bounde unto the forsaide lordes and executers and the said Abbot in M: M: marc sterlings to be paid at the ffest of Pentecost next comyng after the date herof as in the same wryting oblygatory therof made more plainly it ys conteyned *Neverthelesse* the forsaid lordes and executors and the said lorde Abbot for them and their executors woll and grauntyn by thise p'nts that yf the said Petre his executors or assigns or any of them well and truly holde kepe and pfo'me all and singular covn'nts graunts premysses and aggrements and all other things on the partie of the same Peter above rehersid according to the maner and fourme above declared, that then the said wryting obligatory shalbe voide and holde for nought or els to stond in all his full strength effecte and vertue thys endenture in any thing notwtstanding—IN WITNESSE whereof the p'ties aforsaid to thise endentures enterch'ungeably have set their sealys. Yovyn the day moneth and yeres above specifyed."

The screen of this chapel, in its perfect state, was an object of splendour, beauty, and costliness, being an immense brass enclosure, perforated with almost innumerable small arches, quatrefoils, and various other figures, and decorated with numerous pinnacles, canopies, statues, crowns, &c. some of which were richly gilt and enamelled. On viewing the plan of this chapel, Mr. Britton observes, "We feel some surprise at the apparent slightness of the superstructure, or of the space occupied by walls and supports; as the principal weight, and quantity of the building, rests on a few detached piers, and the lateral buttresses. This is a peculiar characteristic of ancient ecclesiastical structures, and manifests great science and skill in the architects. For the nicest geometrical accuracy is required to raise lofty walls, and poise ponderous wide-spreading roofs on piers and columns." The porch is lighted only by two small windows on each side. The gates are of brass, and are divided into several small compartments. The tracery of the blank arches is very elegant. The lower compartment represents a series of seven blank windows, with their proper mullions and tracery; in the upper compartment is displayed a blank window, divided into twelve panels, by eleven perpendicular and one horizontal mullion, over which is a profusion of ornamental tracery. This space is subdivided into four, constituting that number of separate blank windows, of which the two central have rather flattened arches, and the others the regular pointed arch. In the great western window the lower division is blank, as the roof of the porch rises to that height. The upper part, at the sides, is very elaborate in tracery, but the central division seems unfinished. The side aisles of the chapel are separated from the nave by two rows of stalls on each side, which, with their fretted canopies, rise as high as the aisles. Of the screens, which originally separated the nave from the aisles, one is entirely destroyed, and its place supplied by wainscot stalls, and the upper part of the other has been removed. The large pier between these screens, separating the square part of the chapel from that part which is of a semi-octagonal form at the east end, is highly enriched with sculpture, tracery, &c. Over the arches, and immediately beneath the clere-story windows, is a tier of tabernacle work, in detail elaborate, and in effect beautiful: between every two piers are five statues, with pedestals and canopies. The whole of the interior walls of the aisles were covered with tracery, consisting of perpendicular mullions, divided by groining into numerous compartments. The inner roof of this chapel is most complete in its principle of construction, and elaborate in its groining and ornaments. At the west end, over the tomb of the founder, the groining is subdivided into numerous compartments, consisting of varied ornamented with one central and six surrounding pendants, at which the groins converge and unite. The exterior of the chapel is almost as much ornamented as the interior: but nearly the whole of its external surface is much dilapidated, and many of the sculptured and chiselled parts entirely destroyed, owing to its being built of a soft friable stone, which is liable to corrosion by the atmosphere. The excellent plates of the architecture of this building, given by Britton, in the second volume of his Architectural Antiquities, will give the best possible idea of its magnificence. The nave of this chapel is thirty-three feet six inches wide, and the side aisles each eleven feet three inches wide: the extreme length of the whole chapel, including the porch, is one hundred and thirty-four feet, and the corresponding breadth is eighty-two feet six inches.

Wheel-window, a circular window, in form of a wheel.

Whispering Gallery, see *Echo*.

Winchester Cathedral. As connected with the primary establishment of Christianity in Britain, and as the place of coronation and sepulture of Anglo-Saxon, and Anglo-Norman monarchs, the cathedral of Winchester is eminently important to the historian; and, as containing the finest example of the splendid architecture of the time of Wykeham, it is not less important to the architect. According to the old Chronicles, the first church of Winchester was erected by Lucius, the first christian British king. Rudborne tells us, that this church was upon a scale of grandeur and magnificence which has never since been equalled; "its length being 209 paces (about 600 feet), its breadth 88 paces, its height 92 paces, and its the church to the other, 180 paces." According to the same authority, Lucius bestowed on his new church the privileges of sanctuary, agreeably to the laws of Dunwallo Malmutius, a British king, who is said to have lived 500 years before Christ. These and other accounts, however, are so absurd in the particulars, as to need no confuting. By the Saxons we are told the cathedral was converted to a heathen temple, and made subservient to the gloomy and impure rites of Thor, Woden, Frea, and Tuisco. After the conversion of the Saxons, the place was again appropriated to Christianity, and it may with more certainty be stated, from the concurrence of historians, that the cathedral and see of Winchester were founded by Kenewalsh, the son and successor of Kinegils, king of the West Saxons; Kinegils himself had began to build there, where he died and was buried in 643.

King Ethelbald raised fortifications round the cathedral and cloisters, to protect them from the destructive fury of the Danes, and by this means they escaped unhurt.

On the accession of William the Conqueror, Walkelyn, a chaplain and relation to the king, was made bishop of Winchester, and in 1079 he commenced building a large and magnificent cathedral. In 1093, the church and conventual offices were so near completion, that "almost all the bishops and abbots of England assembled in this city to honour the solemn dedication of them which took place on the fifteenth of July, being the festival of St. Swithun, the patron saint of the place." In 1101, (or 1107, according to the annals of Wilton,) the tower of this cathedral fell. During the civil broils of the 12th century, the cathedral suffered in various ways, and the town was entirely deprived of its importance.

The cathedral of Winchester will be best described by the following extracts from the letter of Mr. Garbett to Mr. Britton, and published in his history and antiquities of the cathedral.

"From the historical notices we meet with, we shall find no difficulty in admitting, that great improvements were made in the fabric of the cathedral, at, or about the following stated periods: viz. in the year 313, "by the contributions of private Christians," when Constans was bishop of the see; about the year 584, by the Saxon king Kenewalch: about the year 980, by bishop Ethelwold; and again in the year 1079, by bishop Walkelyn, of whom it is particularly recorded, that he built the tower which was at that time considered a stupendous work.

"When we attentively compare the architecture, and the workmanship of the tower, with that of the greater part of the adjoining transept, we shall not hesitate to ascribe to the latter a much earlier date; for it is not difficult to trace distinctly the junction of the Norman with the Saxon work, not only by the superiority of the masonry, but by the shape of the arches. The two arches of every story, on each side of the transept next to the tower, and the respective piers between them, were evidently rebuilt with the tower; and this may be considered the extent of Walkelyn's work in masonry, as far as respects the cathedral. In addition to this, which was certainly a work of considerable magnitude, it may with great reason be admitted, that he entirely new-roofed the whole of the transept and nave in a manner that might well entitle it to be termed new and magnificent.

"The Norman roof, now remaining, is that of the whole of the transept south of the tower, and that of the whole nave west of the tower, with the exception of about fifty feet in length from the west end, which was evidently destroyed by fire.

"It is presumed, that what has been said of the architecture and workmanship of the tower and transept will prove that some portions of the latter existed previous to the time when Walkelyn is said to have rebuilt it from the ground. It now remains to show, that in the ancient parts there now exists the clearest evidence of additions to the fabric, at a period still more remote; this is to be seen in the design rather than in the execution of the work. The alteration now speaking of, was probably the work of Ethelwald, and consisted of an increase of the substance, and alterations of the shape, of four principal pillars of the transepts, unquestionably for the purpose of supporting a tower at the extremity of each of the side-aisles. It may be objected, that there is no historical notice or tradition of the existence of such towers, but the evidence of the present state of the structure is of the most decisive nature; for the imposts of the arches, which supported the flanks of such towers, are now to be seen distinctly in the spaces between the roof and vaulting of the aisles; and whoever examines with due attention the side arches of the third story of the transept, will perceive that those nearest the extremities, (into which windows have been introduced,) were not originally windows, but open arches of communication with the edifice, similar to those between the body and aisles.

"We now came to the investigation of the work of a period still more remote, which is the *Crypt*, under the part of the church between the high altar and the Virgin chapel. The workmanship in this crypt, though plain and simple in its design, is far superior to any that is to be seen in the whole edifice, excepting those parts which will be hereafter spoken of as the works of De Lucy, and Fox. This work is as much superior to the work of the greater crypt, to which it adjoins, as the Norman is to the Saxon work in the transept; but its inferior dimensions seem to indicate, that it is not the work of the high-spirited Walkelyn, and the circular termination, shows it not the work of a much later period; we may, therefore, conclude, that this is a remnant of the work of our pious British or Roman ancestors, in the early part of the fourth century; and in conformity with the observations before made upon the existing appearances of the fabric, as well as with the historical notices mentioned by Milner and his authorities, we may proceed to define the works of the various builders from that period down to the eleventh century."

What remains of the work of king Kenelwalch, he supposes to be the first story of the transept, except the part described as being rebuilt by the Norman bishop, and some other innovations in the windows. Also, much of the pillars in the nave, though since remoulded and repaired by Wykeham.

Ethelwold's work, he thinks, begins from the base of the second tier of Saxon arches in the transept, and was continued from thence upwards to the height of the present parapet, including the tower before spoken of, and an increase in the length of the nave. "The further work of Ethelwold may be seen in the greater crypt, upon which he of course added a superstructure, though the work now standing over that foundation is of a much later date."

The work of Walkelyn, as before mentioned, he supposes to be confined to the building of the central tower, and such parts of the edifice as immediately abutted upon it, and to the new roofing of the transept and nave.

"We now come to the work of De Lucy, in the consideration of which we are again interrupted by a tower of the old Saxon church, that was left standing in the part eastward of the choir by Walkelyn; and this occasions some difficulty in understanding what was the state of that part of the fabric when De Lucy began his work; for we are to recollect, that the weather-cock falling from the tower in the year 1214, broke the shrine of St. Swithun, which, Dr. Milner justly observes, must have stood near the high altar," and this he attributes to the failure of one of the old towers, before described as having stood at the extremities of the side aisles of the choir; and from various circumstances he concludes, that we must look for De Lucy's tower, which was begun and finished in the year 1200, at the eastern portion of his work, "and we may, therefore, accordingly, recognize a portion of it in the western part of the present Lady Chapel, which has evidently been of greater height at some former period than it is at present; as part of the stair-cases that led to another story are now to be traced, though they are nearly filled up by rough masonry, in effecting subsequent alterations. With respect to the other works executed by De Lucy, there is some reason to suspect, however extraordinary it may appear, that he did not absolutely take down the whole walls of that part of the church situated between the old high altar and his new tower, but that the upper part of the ancient walls were by some means supported while the arches and pillars were inserted under them; for there are indications of those walls having been ornamented, above the present vaulting, with sculpture of a very singular pattern, which is so situated, that it can hardly be considered as the accidental application of old materials re-used; it may, however, be observed, that in all (even the most ancient) parts of the fabric, old materials, exhibiting mutilated mouldings, and other ornaments, are to be seen indiscriminately used in the successive repairs and alterations, from the time of the Saxons down to a very late period." He suspects, that in De Lucy's plan a considerable alteration was made after his decease.

The next person who made any considerable repairs or improvements, was William de Edington, a prelate, who was "in his virtues and talents only inferior to Wykeham himself." Mr. Garbett observes, "It seems highly probable, that the part between the tower and the altar-screen was built by Edington, and that the stalls in the choir were also the work of the same prelate, or of his executors; for upon minute inspection it may be found, that there are many similarities in the execution of these works, and those about his tomb and its enclosures. He also thinks, that at the west end of the fabric, Edington, or his executors, completed 'the two first windows from the great west window, with the corresponding buttresses, and one pinnacle on the north side of the church; as likewise the first window towards the west, with the buttress and pinnacle on the south side.'" He also supposes, that the two west windows of the side aisles were executed at the same time, and probably the two hexagonal turrets.

We now come to the works of the skilful and munificent Wykeham, commenced in the seventieth year of his age, and diligently prosecuted through the remaining ten years of his life. "In proceeding to trace the works of Wykeham, we have an unerring guide in the bishop's own will, as far as it is applicable to this purpose. By it we find, that within fifteen months previous to his decease, so much of his undertaking remained unfinished, that he directed 300 marks to be applied for its completion (a sum far exceeding what he had formerly directed the prior and convent to expend in seven years): and we find, by his directing the walls, the windows, and the vault to be finished throughout, according to the new mode in which he had already completed some parts on the south side, that a considerable part on the north side still remained unfinished: but as we find no mention of the great west window, we may conclude, that he commenced his work in that part." This window, we judge to be Wykeham's work, as also the judicious and elegant alteration of the Saxon pillars, the whole of the windows of the nave and the aisles, except those by Edington, and the vaulting of the aisles "with which the flying buttresses are so ingeniously combined for resisting the pressure of the greater vault." The vault of the nave may be considered as the work of Wykeham's executors, probably assisted by his successor, Cardinal Beaufort."

"The next work in chronological order is the alteration and addition to the Lady Chapel, which Dr. Milner sufficiently proves to have been executed by the priors Hunton and Skilstede." "The chasteness of the design will, I believe, be generally considered to have a more pleasing effect than the profusion of ornaments spread over the neighbouring chapel, which was fitted up by bishop Langton, about the same time, for his sepulchral chantery, and exhibiting many beautiful specimens of curved oak, though they are rather too much crowded to be seen with advantage."

The last who made any extensive repair or improvement on the fabric of the cathedral was bishop Fox, who, in taste, in skill, and in munificence, "is entitled to be considered as the worthy successor of Wykeham and of Waynflete." Mr. Garbett supposes his works to be the two turrets at the eastern extremity of the presbytery—the magnificent window between them—the whole of the ornamental wall over it, terminating with an elegant tabernacle ornamented by the pelican, his favourite emblem, and containing his statue—the timber-framed vaulting of the presbytery—the whole of the aisles north and south of the presbytery, including their windows, roofing, and stone vaulting, with the flying buttresses and pinnacles:—the whole of which was executed in the most perfect style; and the open screens between the presbytery and aisles.

Mr. Britton does not entirely agree with the whole of Mr. Garbett's observations. He is inclined to think, that there are no remains of pure Saxon architecture in the building, and he thinks that the old church was destroyed, and the new one built, by Walkelyn, entirely anew.

"The cathedral church of Winchester," Mr. Britton observes, "has been called '*a school of ecclesiastical architecture*,' and with some degree of propriety; for, as a school is intended to instruct novices in any branch of art or science, so this edifice is calculated to display to the student an interesting and varied series of examples of the ancient architecture of England, from an early age up to a recent period." The exterior is not distinguished by beauty, but by its length of nave, its plainness of masonry, the shortness and solidity of its tower, the width of its east end, and the boldness of its transepts. But the interior will amply compensate for any deficiences in the outside. In the nave and aisles the sublime architecture of Wykeham produces the most impressive effect, while the works of Walkelyn in the tower and transepts, substantial and plain, are at the same time imposing and grand. The north transept exhibits this style with all its effect and character. Every member is in unison with the rest; each is large, bold, and unadorned: the bases, capitals, clustered piers, and single shafts, are equally devoid of ornament. In the carving of the stalls, on the contrary, and the woodwork of the Lady Chapel and Layton's Chapel, we have a redundancy of ornaments, and the designers seem to have wantoned in a licentiousness of fancy: these parts, even from their very caprice, give us pleasure. The elaborate and sumptuous altar screen is covered with niches, canopies, buttresses, pinnacles, pediments, crochets, and similar ornaments. The combined group of chantries, including those for Fox, Beaufort, Waynflete, Wykeham, and Edington, with the screens and clustered columns, is superior to any in Europe. "With such a splendid feast before him," Mr. Britton observes, "it is not to be wondered if the architectural enthusiast indulges himself to excess, and almost satiates his senses."

The nave is characterised by Gilpin, as "perhaps, the most magnificent" in England. The transepts and tower are unrivalled specimens of Norman architecture. The transepts, open to the timber roof, though very lofty, are offensive from the effect of the rafters and ragged timbers. The choir and eastern end are elevated above the nave and aisles by an ascent of several steps. This portion of the building exhibits several different styles of architecture. The presbytery is a large open space between the choir and the altar, separated from the aisles by stone screens, and from the altar by carved railing. The eastern
ing consists of th
pels, of which the
Mary chapel, is
largest.

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The following is
table of the ages a
ferent parts, taken
by Mr. Britton at
history.

Bishops.	Kings.	dae.	Parts of the
Walkelyn	William I.	1079 to 1093	Crypts under the pr and under De Lucy's chapter house; trans ternal parts of the pie nave.
Henry de Blois	Henry I.	1129	Arches in the south tra
De Lucy	Rich. I. John.	1169 to 1205	Aisles of chantry, east part of the Lady ch chapels; the stair-ca
N. Eliensis	Henry III Edw. I, II	1250 to 1310	Presbytery from the screen; old screen, w
Edington	Edward III.	1330	Stalls of the choir; windows on the north Edington's chantry.
Wykeham	Edw. III. Rich. I.	1370 to 1400	Nave and ailes; Wyk tomb.
Beaufort	Henry IV.	1410	Beaufort's chantry.
Waynflete	Henry IV.	——	Waynflete's chantry; th
Courtney	Edward IV.	1480	St. Mary's chapel, pulp
Langton	Henry VII.	1493	Langton's chapel.
	Henry VII.	1500	Fox's chantry; wind presbytery; screens.
Gardiner	Henry VIII.	1540	Gardiner's chantry.
Richard Nelle	Charles I.	1627	Fitting up altar screen;

Wind. The following is Mr. Smeaton's Table of the velocity and force of the wind.

Miles per hour.	Feet per second.	Perpendicular force on one square foot, in pounds avoirdupois.	
1	1.47	.005	hardly perceptible
2	2.93	.020	just perceptible.
3	4.4	.044	
4	5.87	.079	gently pleasant
5	7.33	.123	
10	14.67	.492	pleasantly brisk
15	22.	1.107	
20	29.34	1.968	very brisk
25	36.67	3.075	
30	44.01	4.429	high wind
35	51.34	6.027	
40	58.68	7.873	very high wind
45	66.01	9.963	
50	73.35	12.3	storm or tempest
60	88.02	17.715	great storm
80	117.36	31.490	hurricane
100	146.7	49.2	hurricane that tears up trees, and carries buildings before it.

Wind Beam, an old term for a collar beam.

Window, an opening in the wall of a building, for the admission of light into the interior. In early ages, the windows of habitations were very small and narrow. According to Seneca, the windows of the bath of Scipio were so small, that they scarcely deserved the name; and they resembled rather nicks, or crevices, in the wall. When the Romans began to give their habitations a more commodious disposition, they began also to increase the dimensions of their windows, for the sake of having more light, and a more extended prospect. In the country seats of Pliny, at Laurentinum and Fusci, the windows were very extensive. The houses in Pompeii show that it was not a general custom in towns to have windows on that side of the houses which looked into the court. We find there few houses which have their windows on the outside; and those which do look out into the street are so small, and so high up, that they could serve no other purpose than that of letting in the light. Those rooms in the houses at Pompeii, which were situated around the court have no windows, but were lighted by the door: windows only are observed in those apartments which look into the garden. The use of glass was of late introduction, and, at first, its place was supplied by other transparent substances. See *Phengites.* The fragments of glass, however, found in Herculaneum, prove that this substance was used for windows at the time at which that city was destroyed. The windows of the temple of Jerusalem were formed in the upper part of the wall, or in the roof, for the purpose of admitting light into the interior of the temple. Others think that their use was principally to furnish a means of escape for the smoke of the offerings, and the incense that was continually burning within. The temples of the ancients in general had no windows, though they occur sometimes in the Egyptian temples. See *Temple.*

Windows are a most essential part of every edifice intended for a habitation, as light is one of the greatest requisites of domestic life. At the same time, windows, by a proper disposition, may be made to decorate the exterior of a building, as much even as columns or pilasters. The proportions of windows necessarily ought to differ in different climates. In countries where the sun has little force, and where the winter is cold, the windows should be of large dimensions, that all the warmth and light may be admitted which the sun can yield.

With regard to windows, the first considerations are their number and their size. They must be so arranged, as to admit neither more nor less light than may be requisite.

In the determination of this subject, regard must be had to the climate, the aspect, the extent, the elevation of the building, and its destination, and also to the thickness of the walls in which the windows are to placed; on this circumstance will partly depend the greater or less quantity of light that will be admitted. Where the walls are thick, as they commonly are in stone buildings, the windows should have a considerable splay on the inside, which will admit almost as much light as if the windows were externally of the same size with the increased internal dimensions.

Sky-lights are sometimes used to light staircases, but unless they are made with great care, they are very subject to leak, in a country like ours, where so much rain and snow fall; when they are introduced for stairs, they ought to be double, with a large space between: otherwise they contribute greatly to render houses colder, because they form an easy communication between the internal warm and the external cold air. In hot countries, where the sun is seldom clouded, and where its rays dart more intensely upon the earth, the light is stronger than in those which are temperate or cold; therefore, a smaller quantity of it will suffice, and more than a sufficiency should not be admitted, as the consequence would be the admission of heat. The same happens in respect to a southern aspect, which receives more heat, and consequently more light, than a northern, or even an eastern or western one. A large lofty space requires a greater quantity of light than one circumscribed in its dimensions; and art demands, that the quantity introduced should be so regulated, that it may excite gay, cheerful, or solemn sensations in the mind of a spectator, according to the nature and purposes for which the structure is intended.

Wherever sunshine predominates, light must be admitted and distributed with caution; for where there is an excess of light, the heat becomes dreadfully incommodious to the inhabitant, and injurious to the furniture. In Italy, and some other hot countries, although the windows in general are less than ours, their apartments cannot be made habitable, but by keeping the window-shutters almost closed while the sun appears above the horizon. But in regions where clouds prevail eight months in the year, it will always be right to admit a sufficiency of light, to counteract the gloom of wet and cloudy seasons, and have recourse to blinds or shutters whenever the appearance of the sun renders it too abundant.

The proportions for the apertures of windows depend upon their situation. Their width in all the stories must be the same; but the different heights of the apartments make it necessary to vary the height of the windows likewise. In the principal floor, it may be from two and one-eighth of the width, to two and one-third, according as the rooms have more or less elevation. In the ground story, where the apartments are lower, the apertures of the windows seldom exceed a double square; and when they are in a rustic basement, they are frequently made much lower. The height of the windows of the second floor may be from one and a half of their width, to one and four-fifths; and attics and mezzanines may be either a perfect square, or somewhat lower.

The windows of the principal floor are generally most enriched. The simplest method of adorning them, is with an architrave surrounding the aperture, and crowned with a frieze and cornice. The windows of the ground floor are sometimes left entirely plain, without any ornament, and at others they are surrounded with rustics, or a regular architrave, with a frieze and cornice. Those of the second floor have generally an architrave carried round the aperture; and the same method is adopted in adorning the attic and mezzanine windows: but the two last have seldom either frieze or cornice, whereas the second-floor windows are often crowned with both. The breasts of all the windows on the same floor should be on the same level, and raised above the floor from two feet nine inches, to three feet six inches at the most. When the walls are thick, the breasts should be reduced under the apertures, for the conveniency of looking out. When the building is surrounded with gardens, lawns, or other beautiful objects, the French method of continuing the windows quite down to the floor, renders the room exceedingly pleasant; but when this mode is adopted in close streets, where it contributes to nothing but rendering houses colder, it is truly ridiculous. The intervals between the apertures of windows depend in a great measure on their enrichments. The breadth of the apertures is the least distance that can be between them; and twice that breadth should be the largest in dwelling-houses; otherwise the rooms will not be sufficiently lighted. The windows in all the stories of the same aspect must be placed exactly above one another. The mathematical rule of apportioning light to rooms, is as follows:—multiply the length of the room by the breadth, and multiply the height by the product of the length and breadth; and out of that product extract the square-root, which is the light required. For example, suppose a room to be forty feet by thirty, and the height sixteen feet, the square-root will be one hundred and thirty-eight feet four inches; which may be divided into four windows, and each window will contain thirty-six feet, superficial. The height of each of these windows will be nine feet and the width four feet. Suppose a room to be thirty-six feet by twenty-four, and fifteen feet in height, the square-root will be one hundred and thirteen feet; which divided into four parts, or windows, will give twenty-eight feet three inches to each window. The height of the windows will be eight feet six inches, and the width three feet four inches; and so for any others, by the same rule of proportion.

Windsor Castle. This castle was built first by William the Conqueror, probably more for a military post, for which, by its situation, it was well adapted, than for the residence of himself, or of his successors. A new out-work, or barbican, is recorded to have been built by Henry II. Edward I. and his successor, Edward II., frequently made it their place of residence. It is, however, agreed by all historians, that this castle owes its splendour to Edward III. In 1334, Walsingham relates, he built a chamber, which he called the round table, 200 feet in diameter, which, however, appears to have been only a temporary structure. In 1356, William of Wykeham was made clerk of the works, (see *Wykeham*;) and, in 1359, Hollingshed tells us, that "the king set workmen in hand, to take down much old buildings belonging to the castle of Windsor, and caused divers other fair and sumptuous works to be set up in and about the same castle, so that almost all the masons and carpenters, that were of any account within the land, were sent for, and employed on the same works." The next year, three hundred and sixty workmen were impressed, to be employed on the buildings at the king's wages, some of whom having clandestinely left Windsor, and engaged in other employments for greater wages, writs were issued to prevent persons from employing them, on pain of forfeiting all their goods and chattels, and threatening to commit such of the workmen as were apprehended, to Newgate. The plague having carried off a great number of the king's workmen in 1362, new writs were issued to the sheriffs of several counties, to impress three hundred and two masons and diggers of stone, to be employed in the king's works; and the counties of York, Salop, and Devon were to furnish sixty each. Very few commissions were issued after 1369, and none after 1373, so that it may be presumed that this noble work was then completed—comprising the king's palace, the great hall of St. George, the lodgings on the east and south sides of the upper ward, the round tower, St. George's chapel, the canons' houses in the lower ward, and the whole circumference of the walls, with the towers and gates. The castle continued to be the occasional residence of our monarchs, who from time to time made various alterations in the buildings, particularly Henry VII. Soon after the breaking out of the civil war, it was garrisoned by the parliament, and sustained an attack in 1642, by prince Rupert, who was unsuccessful. On the restoration, Charles II., finding the buildings of the castle much dilapidated by plunder and neglect, caused it to be thoroughly repaired, and richly furnished; and, during the greater part of his reign, he made Windsor his summer residence. Later improvements were made under the direction of Wyatt.

The castle consists of two courts, between which is the keep, or round tower. The upper court, or ward, contains, on the north side, the state apartments, chapel, and hall of St. George.

St. George's hall was built by Edward III. as a refectory for the knights companions of the garter, and is a noble room, of a hundred and eight feet in length. The ceiling and walls were painted by Verrio, the subject being the triumphs of Edward III. and Edward the Black Prince, his son. In the area of this upper court is a bronze statue of Charles II., by Stada. On the north side of the castle is the terrace made by queen Elizabeth, and extended by Charles II. along the east and south sides; its whole length is 1870 feet, and it is considered as the noblest of the kind in Europe.

The keep, or round tower, for the residence of the governor of the castle, situated between the two wards, or courts, consists of a lofty, artificial, cone-shaped mount, surrounded by a mote, and surmounted by a strong fortified tower, which is approached by a flight of a hundred steps.

The chapel of St. George is situated on the north side of the lower court of the castle. The collegiate chapel of St. George is, as Mr. Britton observes, " the largest in dimension, the most chaste and elegant in architectural style and character, and the most diversified in external and internal arrangement, of the three royal chapels in England." The whole building, it is evident, has been designed and constructed at different times; and we may perceive in it readily the styles of periods, various and distinct, from the reign of Henry III. to that of Henry VIII.; but we have no documents to determine the commencement and termination of each respective part. We have authentic documents to prove, that part of it was built during the reigns of Henry III. and Edward III., who was particularly partial to Windsor. In his reign we learn that the prices of labour were, per day: — For master mason, 1*s.*; common mason, 5½*d.*; mason's apprentice, 2*d.*; porter, or labourer, 3*d.*; scaffold-maker, 3½*d.*; carpenter, 4*d.* and 5*d.*; plasterer, 6*d.*; tyler, 3*d.*; painter, 6*d.*, 7*d.*, 8*d.*, 9*d.*, 10*d.*, and 1*s.*—Of materials, *gobetts*, or *gobbets*, (stones so called, from Caen,) 4*l.* per hundred; Caen stones, called *coins*, 12*s.* 6*d.* per hundred; Ryegate stones, (for mullions, dressing of windows, &c.) alder-tree beams for scaffolding, and hurdles for the same purpose, 2*d.* each; wax, to make cement, 6*d.* a pound; pitch, for the same purpose, 1*d.* a pound; lime, for mortar, 3*s.* 6*d.* per hundred; sand, for mortar, 1*d.* a cart-load; white plaster, 1*s.* 3*d.* a bushel; white glass, 4*d.* a foot. In 1390, the fourteenth year of Richard II., Geoffrey Chaucer, the poet, was made "clerk of the works" to St. George's chapel, which is described as then being upon the point of falling to the ground. The design, and greater part of the present edifice are generally attributed to Richard Beauchamp, bishop of Salisbury, who was master and surveyor of the works in the fifteenth year of Edward IV. and who, according to Gough, was accounted the Wykeham of his day. He was succeeded in the superintendence of the work by Sir Reginald Bray, the prime minister to Edward VII. To his skill and munificence the chapel of St. George owes much, and his arms occur frequently on the ceiling and windows. The chapel on the south side, still called Bray's chapel, was built by him to receive his body. The roof, or groined ceiling, of the choir, was not begun till the twenty-first year of the reign of Henry VII., when John Hylmer and William Vertue, freemasons, agreed by indenture, dated June 5, A. D. 1507, after Sir Reginald's death, to construct that part of the vaulting for the sum of £700, and to complete it by Christmas 1508.

The building stands on a sloping ground, with a gradual declivity from east to west. It presents a uniform arrangement of parts in the plan. Each side of the nave consists of seven similar compartments, with corresponding piers, panelling over the arches, windows, and panelling in the aisles, upper tier of windows, also groining spring from the clustered columns. A fascia, or frieze of half angles, beneath the upper windows, extends all round the building. Above these beads is shown an elegant ornament of lozenge-shaped leaves, &c. a genuine mark of the Tudor style. Each transom of the windows has an embattled moulding. The west window fills up the whole width of the nave, and is divided into three large compartments, each of which is subdivided by smaller mullions into five lights: horizontally it is composed of six tiers of lights, each having a cinque-foil head. The groining of the roof in the vaultings of the nave, choir, side-aisles, and transepts, is a just object of admiration, and is distinguished by its elegant forms and numerous ramifications. The compartment over the organ screen is the most elaborate. The bosses are charged with the badge of Sir Reginald Bray, and the initials of his name.

The arrangement of the parts in this chapel, in the plan, and in the elevation of the ends and sides, is uniform, except in the following particulars. A modern chapter-house occupies the north-east angle, and varies considerably from the Lincoln chapel at the corresponding angle; near it is a staircase turret, and a recess cut in one of the buttresses. There is also a modern perch at the south transept, which does not accord with the rest of the building. The chantries or monumental chapels are numerous: each was originally founded by a private person, and intended to contain his own or a family tomb. The Beaufort chapel, or chantry, contains, among others, a gorgeous monument of white marble, with four Corinthian columns, so the memory of Henry Somerset, duke of Beaufort, who died in Jan. 16, 1699. This chapel was greatly injured during the civil wars, but has since been restored. The Urswick chapel received its name from Dr. Christopher Urswick, dean of Windsor, who appears to have contributed towards the completion of the chapel. Rutland chapel, or the north transept, was founded by Sir Thomas St. Ledger, or Sentlynger, for the interment of his wife, Anne, duchess of Exeter, sister of Edward IV. Hastings chantry, which was built by Elizabeth, the wife of William, Lord Hastings, who was chamberlain to Edward IV. corresponds in design and shape with the Oxenbridge chantry, occupying the whole width between two piers of the choir, and consisting of an open screen, with a door-way to the aisle, and a flat-wall towards the choir, its roof groined, and its sides ornamented with niches. The Lincoln chantry contains the tomb of Edward, earl of Lincoln, who died in 1584. The Oxenbridge chantry was erected by John Oxenbridge, a canon, in 1522, and dedicated to St. John the Baptist, whose history is represented in three compartments at the back; in the spandrils of the door, the name of the founder is symbolically represented by the figure of an Ox, an N, and a Bridge. Oliver King's chantry, called also the Aldworth chapel, which is an extraneous little building, is, on account of its bad style, a blemish to the southern side of the building: it is said to have been built by Oliver King, bishop of Bath and Wells. The south transept, or Bray chapel, contains a modern front, and several tablets and monuments. A monument erected to William Fitzwilliam, who died Oct. 13, 1659, is worthy of attention, as, according to Mr. Britton, "the design and mode of workmanship shew the decline, the last struggle, of the Tudor style of church architecture."

At the east end of the chapel is a distinct, though attached building, called the tomb-house, which was commenced by Henry VII., and intended for his burial-place; it was granted by Henry VIII. to cardinal Wolsey, who began in it a sumptuous monument for himself: this, however, was destroyed in the civil wars. James II. fitted up the building as a Roman catholic chapel, and publicly attended the celebration of mass. After his time it was deserted, but it was repaired by George III., and appropriated for the interment of his family.

The circumference of the whole castle is estimated at four thousand one hundred and eighty feet;

its length from east to west is one thousand four hundred and eighty feet; and its area, exclusive of the terrace walks, is about twelve acres.

Wire.—Colonel Dufour erected at Geneva suspension bridges of iron wire, instead of bars, on the well-ascertained principle, that a small wire of iron is capable of supporting a much greater weight, in proportion to its size, than a larger cylinder of the same material. This increased tenacity or strength appears to be produced in a great measure by the operations of hammering, rolling, and drawing, which, it is believed, render the metal more compact and solid, the particles being brought into closer compact by compression, and their cohesive force consequently increased. Colonel Dufour found, from the experiments that he made, that iron wires, of from one to four millimetres in diameter, supported at least 132 lbs. for each square millimetre of their section; those of six millimeters, from 88 to 100 lbs. per square millimetre; and larger cylinders of iron, from 55 to 60 lbs. only—which sufficiently demonstrate the great advantage of employing wire in preference to bars of iron, in suspension bridges, as a greater tenacity is acquired with only half the weight of metal. An account of Colonel Dufour's bridges is given in the first volume of the first series of the Register of Arts.

Withs, (Sax.) the partitions of chimney-flues.

Wood. An account of the different kinds, &c. of Wood has already been given, under the article **Timber.** We shall here only give some observations on the best mode of staining it of different colours.

The following are the best processes for staining common woods, in imitation of the finer sorts.

Artificial Ebony, is made by boiling smooth clean box in oil, till it becomes perfectly black; or by washing pear-tree wood with aquafortis, and drying it in a shady place in the open air; after which, common writing ink should be repeatedly passed over it, and the wood dried in a similar manner, till it acquire a deep black colour. It may then be polished with wax and a woollen cloth, which will give it a fine lustre. A very fine black is also produced by a solution of copper in aquafortis, and afterwards brushed over with a decoction of logwood.

Rosewood, may be admirably produced by brushing over the wood repeatedly a strong decoction of logwood, and, after it is dry, applying with a piece of cane bruised very coarsely, to be used as a brush, a solution of copperas, or, which is better, of iron filings in vinegar, in such a manner as to imitate the grain of the wood.

Mahogany. An excellent imitation of mahogany may be obtained by heating over a fire some dragon's blood dissolved in oil of turpentine, in which is immersed some plane-tree wood. This mode is practised in Germany, and produces a beautiful colour; but, as some danger is incurred from the liability of the oil of turpentine to take fire, it has been recommended to boil the wood well in simple water, and then to take it out, and, while hot, to brush it over repeatedly with the solution of dragon's blood in oil of turpentine. Another method, which answers well, particularly with elm, maple, and sycamore, is, to dissolve two drachms of dragon's blood, one drachm of alkanet root, and half a drachm of aloe, in half a pint of rectified spirits of wine: the wood should be first moistened with aquafortis, and two or three layers of the mixture applied, each being allowed to dry before the next is applied.

A light *red-brown Mahogany* colour may also be given to wood, by means of a decoction of madder and fustic wood, ground in water, in the proportion of half a pound of madder, and a quarter of a pound of fustic, to a gallon; or, instead of the fustic, an ounce of French berries may be used. The wood must be brushed over with this solution, while boiling hot, till the proper colour be obtained. By substituting, for the fustic, two ounces of logwood, *a dark Mahogany* colour will be obtained. When the wood has been brushed over several times, and is dry, brush it over with water in which pearl-ashes have been dissolved, in the proportion of a quarter of an ounce to a quart. The wood, in the better kind of work, should be afterwards varnished with three or four coats of seedlac varnish.

To dye wood a *fine yellow*, dissolve gamboge in spirit of turpentine, and wash it over the wood: the addition of dragon's blood will produce an *orange* tint. Turmeric dissolved in spirits of wine also answers well.

Wood may also be stained yellow by brushing it over several times with the tincture of turmeric root, made by putting an ounce of the powdered root to a pint of spirit, and, after it has stood some days, straining off the tincture. To this also a little dragon's blood may be added, to give it a redder cast. A cheaper and less bright yellow may be given by rubbing the wood over with the tincture of French berries made boiling hot, and, when the wood is dry, brushing it over with weak alum-water used cold.

For a deep *black*, the wood may be brushed over four or five times with a warm decoction of logwood, made in the proportion of one pound of logwood to a gallon of water, and boiled for an hour or more. Afterwards black it over as often with a decoction of galls, allowing it to dry thoroughly between each application of the liquor. Thus prepared, it receives a fine deep colour, from being washed over with a solution of vitriol, in the proportion of two ounces to a quart; in the room of which, some use a solution of iron in vinegar, keeping the vinegar for this purpose, upon a quantity of iron filings, and pouring off a little as it is wanted. A pretty good black is also obtained by brushing over the wood first with the logwood liquor, and afterwards with common ink. A very fine black may be produced by brushing over the wood several times with a solution of copper in aquafortis, and afterwards with the decoction of logwood, repeated till the colour be of sufficient force, and the greenness produced by the copper overcome.

To die wood a fine *blue*, put two drachms of the best indigo in powder in a glass, with two ounces of oil of vitriol, and stir them with a new clay pipe. When it has stood for ten or twelve hours in a temperate place, pour it into a large glass or earthen vessel, and add as much clear water as is requisite to produce the tint required. Another method is, to dissolve verdigris in distilled vinegar, and making a separate solution of two ounces of pure pearl ashes in a pint of water, first applying the former to the wood several times, till it be of a sufficiently deep green, and then applying the latter with a soft painter's brush, till it becomes of the blue tint required. If a *green* stain is required, the dissolved verdigris may be used alone.—To dye wood *purple*, boil a quart of water, two ounces of Brazil wood, and one ounce of logwood, till one half is evaporated; strain it off and lay it on with a painter's brush. Afterwards apply a weak solution of pearl ash.

To dye wood *red:* take two ounces of Brazil wood, and two drachms of purified potash; mix them in a quart of water, and infuse for two or three days, then strain it, and make it boiling hot, and brush over the wood with it, until it is highly coloured, when, while wet, it must be brushed over with a solution of alum, (in the proportion of two ounces to a quart.)

To dye wood *pink* or *rose-red*, add to this infusion of Brazil wood a quarter of an ounce of pearlash, and use it as before, applying the alum-water several times.

To increase the brilliancy of any of the foregoing stains, use a varnish of seed or shell lac. For coarser work, a varnish of resin and lac may be used, or drying oil; or even a little bees' wax only.

Wreathed Columns, columns twisted in the form of a screw.

Wren, Christopher, a learned and illustrious English architect, was nephew to bishop Wren, and the son of Dr. Christopher Wren, who was fellow of St. John's College, Oxford, and afterwards chaplain to Charles I. His father was also a skilful architect and mathematician; and, in the state papers of the earl of Clarendon, vol. i. p. 27, is an estimate of a building to be erected for her majesty by Dean Wren. Christopher Wren was born at Knoyle, Oct. 20, 1632, and, while very young, discovered a surprising turn for learning, especially for mathematics. He was sent to Oxford, and admitted a gentleman commoner at Wadham College, at about fourteen years of age. In 1652, he took his master's degree, having been chosen fellow of All Souls' College, and, soon after, became one of that ingenious and learned Society, who then met at Oxford, for the improvement of natural and experimental philosophy.

In August, 1657, Wren was chosen professor of astronomy in Gresham College, and his lectures, which were much frequented, tended greatly to the promotion of real knowledge; and on the fifth of February, 1660-1, he was chosen civilian professor of astronomy at Oxford, in the room of Dr. Seth Ward, on which he entered in May, and in September was created doctor of civil law.

Among his other eminent accomplishments, Wren gained so considerable a skill in architecture, that he was sent for the same year from Oxford, by order of Charles II., to assist Sir John Denham, surveyor-general of his majesty's works. In 1663, he was chosen fellow of the Royal Society, being one of those who were first appointed by the council, after the grant of their charter. He did great honour to this illustrious body by many curious and useful discoveries in astronomy, natural philosophy, and other sciences.

In 1665, he went over to France, where he not only surveyed all the buildings of note in Paris, and made excursions to other places, but took particular notice of what was remarkable in every branch of mechanics, and contracted acquaintance with all the considerable virtuosi. "The great number of drawings he made from their buildings," Walpole observes, "had but too visible influence on some of his own; but it was so far lucky for Sir Christopher, that Louis XIV. had erected palaces only, no churches. St. Paul's escaped, but Hampton Court was sacrificed to the god of false taste. Yet I have been assured, by a descendant of Sir Christopher, that he gave another design for Hampton Court, in a better taste, which queen Mary wished to have executed, but was over-ruled."

On his return from France, he was appointed architect, and one of the commissioners for the reparation of St. Paul's cathedral. Within a few days after the fire, which began September 2, 1666, he drew a plan for a new city; but the execution of his noble design was unhappily prevented by the disputes which arose about private property, and the haste and hurry of rebuilding, though it is said that the practicability of Wren's whole plan, without infringement on any property, was at that time demonstrated, and all material objections fully weighed and answered.

In 1668, Wren succeeded Sir John Denham in the office of surveyor-general of his majesty's works, and in 1669 finished the theatre at Oxford, which will be a lasting monument of his great abilities as an architect. In this building, the admirable contrivance of the flat roof, which is eight feet over the one way, and seventy the other, without any arched work or pillars to support it, is particularly remarkable. The conflagration of the city of London gave him many opportunities of employing his genius; and the variety of business in which he was by this means engaged, requiring his constant attendance and concern, he resigned his civilian professorship at Oxford in 1673, and the year following received from the king the honour of knighthood.

Soon after this, he married the daughter of Sir Thomas Coghill, of Belchington, in Oxfordshire, by whom he had one son, Christopher; and after her death, which happened soon after, he married a daughter of William Lord Fitzwilliam, baron of Lifford in Ireland, by whom he had a son and a daughter. In 1680, he was chosen president of the Royal Society. In 1684, he was principal officer or comptroller of the works in the castle of Windsor. He sat twice in parliament as a representative for two different boroughs, which were Plympton in Devonshire, and Melcomb-Regis in Dorsetshire. In consequence of a court intrigue, in April, 1718, his patent for royal works was superseded, after he had reached his eighty-sixth year; and Walpole has well observed, "that the length of his life enriched the reigns of several princes, and disgraced the last of them." He died on the 25th of February, 1723, at the age of ninety-one, and was interred, with great solemnity, in the vault under the south wing of the choir, near the east end of St. Paul's cathedral. On the side of a pillar is the following inscription:—

SUBTUS CONDITUR
HUJUS ECCLESIÆ ET URBIS CONDITOR,
CHRISTOPHERUS WREN,
QUI VIXIT ANNOS ULTRA NONAGINTA,
NON SIBI SED BONO PUBLICO.
LECTOR, SI MONUMENTUM REQUIRIS,
CIRCUMSPICE.
OBIIT XXV. FEB. ANN. MDCCXXIII.
ÆTAT. XCI.

"As to his person," observes the writer of the General Biographical Dictionary, to whom we are indebted for the greater part of our notice of his life, "he was of low stature, and thin; but by temperance and skilful management, for he was not unacquainted with anatomy and physic, he enjoyed a good state of health to a very unusual length of life. He was modest, devout, strictly virtuous, and very communicative of what he knew. Besides his peculiar eminence as an architect, his learning and knowledge was very extensive in all the arts and sciences, and especially in the mathematics. Mr. Hooke, who was intimately acquainted with him, and very able to make a just estimate of his abilities, has comprised his character in these few but comprehensive words: 'I must affirm,' says he, 'that since the time of Archimedes, there scarcely ever has met in one man, in so great a perfection, such a mechanical hand, and so philosophical a mind.' And a greater than Hooke, even the illustrious and immortal Newton, whose signet stamps an indelible character, speaks thus of him, with other eminent men: —'D. Christopherus Wrennus, Eques Auratus, Johannes Wallisius, S. T. D., et D. Christianus Hugenius, hujus ætatis geometriarum facile principes.'"

Among the many public buildings erected by Wren in the city of London, the church of St. Stephen, in Walbrook; that of St. Mary-le-Bow; the monument; and the cathedral of St. Paul—may be cited as the most celebrated. To defray the expenses of building the latter, the chamber of London was made an office for the receipt of contributions, and, in the space of ten years only, the sum of £126,000 was paid into it. Charles the Second generously gave a thousand pounds a year out of his privy purse, besides a duty on coals, which produced five thousand pounds a year, over and above all other grants in its favour. Sir Christopher prepared a design, well studied and truly magnificent, conformable to the best style of the Greek and Roman architecture, which all approved, except the bishops, who thought it not sufficiently laid out in the cathedral fashion. The design was therefore varied in many respects, until the plan of the present mighty structure, which is in the form of a long cross, was unanimously approved; soon after which, the building was put in hand, and the first stone was laid by Sir Christopher himself, on the 21st of June, 1675.

"The church of Walbrook," it is observed by the author of the critical review of the public buildings, &c. of London, "is famous all over Europe, and is justly reputed the masterpiece of the celebrated Sir Christopher Wren. Perhaps Italy itself can produce no modern building that can vie with this in taste or proportion. There is not a beauty which the plan would admit of, that is not to be found here in its greatest perfection; and foreigners very justly call our judgment in question, for understanding its graces no better, and allowing it no higher a degree of fame." The steeple of St. Mary-le-Bow, which is particularly grand and beautiful, stands upon an old Roman causeway, that lies eighteen feet below the level of the present street; and the body of the church stands on the walls of a Roman temple.

The following is a list of the churches of the city of London, royal palaces, hospitals, and public edifices, built by Sir Christopher Wren, whilst he was surveyor-general of the royal works.

St. Paul's Cathedral.
Allhallows the Great.
Allhallows, Bread Street.
Allhallows, Lombard Street.
St. Alban, Wood Street.
St. Anne and Agnes.
St. Andrew, Wardrobe
St. Andrew, Holborn.
St. Antholin.
St. Austin.

St. Bene't, Gracechurch.
St. Bene't, Paul's Wharf.
St. Bene't, Fink.
St. Bride.
St. Bartholomew.
Christ's Church.
St. Clement, Eastcheap.
S. Clement, Danes.
St. Dionis, Backchurch.
St. Edmund the King.
St. George, Botolph Lane.
St. James, Garlic Hill.
St. James, Westminster.
St. Lawrence, Jewry.
St. Michael, Basinghall.
St. Michael, Royal.
St. Michael, Queenhithe.
St. Michael, Wood Street.
St. Michael, Crooked Lane.
St. Michael, Cornhill.
St. Martin, Ludgate.
St. Matthew, Friday Street.
St. Margaret, Lothbury.
St. Margaret Pattens.
St. Mary, Abchurch.
St. Mary, Aldermanbury.
St. Mary-le-Bow.
St. Mary Magdalen.
St. Mary, Somerset.
St. Mary at Hill.
St. Nicholas Cole Abbey.
St. Olave, Jewry.
St. Peter, Cornhill.
St. Swithin, Cannon Street.
St. Stephen, Walbrook.
St. Stephen, Coleman Street.
St. Mildred, Bread Street.
St. Mildred, Poultry.
St. Magnus, London Bridge.
St. Foster's Church.
Westminster Abbey, repaired.
St. Christopher.
St. Dunstan in the East.
St. Mary, Aldermanbury.
St. Sepulchre's.
The Monument.
Custom House, London.
Winchester Castle.
Hampton Court.
Chelsea Hospital.
Greenwich Hospital.
Theatre at Oxford.
Trinity College Library, Cambridge.
Emmanuel College Chapel, Cambridge.
&c. &c.

Wyatt, James, an eminent modern architect, was born at Burton, in Staffordshire, about the year 1743, of a respectable family, and having at an early period showed great genius for architectural design, his friends succeeded in introducing him into the suite of Lord Bagot, then about to go as the ambassador of England to Rome. There he studied the architecture of Italy, and stored up that transcendent knowledge of the rules of his profession, and that exquisite taste for the development of those rules, which placed him without a rival among British architects. He was frequently heard to say, that he had measured with his own hand every part of the dome of St. Peter's, at the imminent danger of his life, as he was obliged to lie on his back on a ladder slung horizontally, without cradle or side-rail, over a void of three hundred feet. From Rome he went to Venice, and there studied some time under the celebrated architect Viscentini, under whom he acquired an unusual perfection in architectural painting. At the age of twenty he returned to London with a taste formed by the finest models of ancient Rome, and the instruction of the best living masters in Italy. He was first employed on the Pantheon, in Oxford-street, the grandeur and symmetry of which procured him the admiration of every person of taste in Europe. He was invited by the empress of Russia, through her ambassador at London, to settle at St. Petersburg; but, at the recommendation of his friends, he declined the offer of the munificent Catherine. On the death of Sir William Chambers, he was appointed by the king to the office of surveyor-general to the board of works. A dispute having arisen in the Royal Academy, which induced Mr. West to relinquish the president's chair, Mr. Wyatt was elected, and reluctantly accepted the vacant office at the king's express desire, but he restored it to Mr. West the ensuing year. Mr. Wyatt died by an accident on the fifth of September, 1813, at a about seventy years of age. He was on his way to London with Mr. Codrington, in that gentleman's carriage, when it was overturned near Marlborough, and the suddenness and violence of the accident is supposed to have produced a concussion of the brain, as he died instantly. Among the principal works of this celebrated man, are—the palace at Kew, Fonthill Abbey, Hanworth Church, the House of Lords, parts of Henry the Seventh's Chapel and Windsor Castle, Bulstrode, Doddington Hall, Cashiobury, Ashbridge Hall, &c. The writer of his life observes, that although he was educated a Roman architect, and made his grand and successful debut in England under that character, yet his genius was not to be bounded in a single sphere, and it afterwards revived in his country the long forgotten beauties of the Gothic style. However, it has been observed, that Mr. Wyatt was far from being successful, either in his original attempts, or in his restorations of the pure Gothic.

Wykeham, William of, illustrious for his patronage of and skill in architecture, was born at Wykeham, in Hampshire, in 1324, of a respectable family, though his parents were then reduced in circumstances. He found, however, a patron, who is supposed to have been Nicholas Uvedale, lord of the manor of Wykeham, and governor of Winchester Castle, who maintained him at Winchester school, where he gave early proofs of piety and learning. He was afterwards recommended to the notice of Edward III., and was introduced at court at about twenty-two or twenty-three years of age. There is every reason to suppose that his skill in drawing recommended him to a sovereign, who was bent on adding to his country the ornament and utility of magnificent and durable structures. The office he first held was that of clerk of all the king's works in the castle and park of Windsor, to which he was appointed in May 1356; and it was by his advice, that the king was induced to pull down great part of his castle; and by his skill, that it was rebuilt nearly in the manner in which it now stands. His other great work was Queenborough Castle; and although in these military structures he had little scope for the genius which he afterwards displayed at Oxford and Winchester, they would have been sufficient to prove that he had already reached that degree of architectural skill which modern art can scarcely imitate.

Wykeham now quickly became a favourite with his sovereign, who bestowed on him various marks of royal favour. He was successively promoted to a variety of ecclesiastical preferments; and the annual value of his livings, for some time before he became bishop of Winchester, amounted to eight hundred and forty-two pounds: but it is recorded of him, that "he only received the revenues of the church with one hand, to expend them in her service with the other." While he was dean of St. Martin le Grand, in London, he rebuilt, at his own expense, the cloister of the chapter-house, and the body of the church. His civil promotions were equally rapid and honourable with those which he obtained in the church. On the death of his old friend and patron, William de Edyngdon, bishop of Winchester, in 1366, Wykeham was immediately and unanimously elected by the prior and convent to succeed him, and, shortly after, he was appointed chanceller of England. Soon after his being settled in the bishopric of Winchester, he began to employ his architectural skill in the repairs of the cathedral, the whole expense of which was defrayed by himself, but his more enlarged designs for this edifice were delayed to a more distant period.

By the intrigues of a party, headed by the duke of Lancaster, in the last year of the reign of Edward III., an accusation, branching into eight articles, was brought against Wykeham; but, upon a fair trial, seven were found entirely destitute of proof, and the eighth only was laid hold of as a pretext for seizing into the king's hands the temporalities of the bishopric of Winchester, excluding the bishop from parliament, and removing him from court. At the ensuing convocation, the bishop of London, William Courtney, had the spirit to oppose any subsidy to the king until satisfaction should be made for the injury done to the whole body of the clergy, in the person of the bishop of Winchester; and he was so firmly supported by the convocation, that the archbishop of Canterbury, though a warm partizan of the duke of Lancaster, was obliged to admit Wykeham into their assembly, where he was received by every member with every possible mark of respect. He was soon after restored to his temporalities, and during the following reign was equally distinguished as a benefactor, a legislator, and an architect, and gained from every one the character of a statesman of the most inflexible integrity.

In 1379, having completed the several purchases of land necessary for that purpose, he obtained the king's patent or license to found New College, Oxford, dated June 20th, and likewise the pope's bull to the same effect, and the foundation stone was laid March 5, 1380, and the whole completed in six years. The year after this college was finished, he began another at Winchester, which was likewise completed in six years, with a magnificence scarcely inferior to that at Oxford. He died in 1404, in his eightieth year, and was interred in the beautiful chantry which he had built for himself in Winchester cathedral. In this cathedral we still see the triumphs of his skill, in the main body of the edifice from the tower to the west end, but more particularly in his chantry.

X.

Xenodochium, (Gr. ξενος, a guest, δεχομαι, to receive,) the name given by the ancients to a hospital, or an inn, for the reception of strangers.

Xystus, (Gr.) "The word *xustos* with them, (the Greeks,) is applied to a spacious portico, in which the athletæ exercise themselves during winter: the Romans, on the contrary, term the hypæthral walks *xysti*, which are called *peridromides* by the Greeks." Vitruvius, lib. iv. c. 10.

Y.

Yacht, or *Yatch*, in naval architecture, a vessel of state, usually employed to convey princes, ambassadors, or other great personages. As its principal design is to accommodate the passengers, it is usually fitted with a variety of convenient apartments, with suitable furniture, according to the quality and number of the persons it is intended to contain. The royal yachts are generally rigged as ketches, except the principal one reserved for the sovereign, which is equipped with three masts like a ship. They are generally richly ornamented with sculpture, and are commanded by captains in his majesty's navy. There are also many other yachts of a smaller kind, employed by the commissioners of the excise, &c. or used as pleasure-boats by private gentlemen.

Yard *measure*, see *Weights and Measures.*

Yard, in naval architecture, a long piece of timber suspended upon the masts of a ship, to extend the sails to the wind. The *yard-arm* is that half of the yard that is on either side of the mast, when it lies athwart the ship.

Ybsambul, or *Ebsambul*, a village in Nubia, celebrated for the remains of its magnificent temples. The first, or northernmost, stands just over the bank of the river, about twenty feet above the surface of the water, and is cut out of the sandstone rock. In front of the entrance, in narrow recesses facing the river, are six colossal figures, three on each side of the door, each accompanied with smaller figures. They are, according to Burckhardt, "1. A juvenile Osiris, with a narrow beard and a tiara on his head, accompanied by two small erect figures, about four feet in height, one on each side the legs. 2. Isis, with Horus in her arms, and a small figure also on each side; though coarsely executed, the countenance of the Isis is truly grand and benevolent. 3. A youth, with the usual high bonnet upon his head, his arms hanging down, attended by two small figures like the preceding. On the other side the door, 4. The same youth. 5. Isis, having upon her head the globe, encompassed with two serpents. 6. The youth a third time: each with the two small attendant figures as before." Over the door appear Osiris and the hawk-headed deity, seated back to back, receiving offerings. The spaces between the recesses that contain the statues are covered with hieroglyphics.

The whole of the front, which has been wrought out of the rock, is a hundred and eleven feet long. It is supposed to have been dedicated to Isis. The door leads into the pronaos, which is thirteen paces by seven; this is supported by six square columns, three feet square, with Isis-headed capitals, like those at Dendera, except that they are in much lower relief, and that the hair falls down in two thick ringlets. Both the columns, the walls, and the ceilings are adorned with hieroglyphics and symbolic figures. The figures appear to have been all painted yellow, except the hair, which is black: that of Isis is in black and white stripes. From the pronaos we enter the narrow cella by one large and two smaller doors. The cella is only three paces in depth, and has a dark chamber on each side. The adytum is seven feet square: in a niche at the upper end, are remains of a small sitting statue, cut out of the rock; and in the floor is a deep sepulchral excavation. The style of the sculptures in this part indicates a high antiquity.

The second, or more southern temple, is the *ne plus ultra* of Egyptian labour; and no other temple, either of Egypt or Nubia, can be put in competition with it. The first notice of it was given by Burckhardt, but the interior was first laid open by Belzoni, in 1817.

Burckhardt gives the following description of the appearance of this magnificent excavation, at the time of his visit:—

"Having, as I supposed, seen all the antiquities of Ebsambul, I was about to ascend the sandy side of the mountain by the same way I had descended, when, having luckily turned more to the southward, I fell in with what is yet visible of four immense colossal statues, cut out of the rock, at a distance of about two hundred yards from the temple: they stand in a deep recess, excavated in the mountain, but are now almost entirely buried beneath the sands, which are here blown down in torrents. The entire head, and part of the breast and arms, of one of the statues, are yet above the surface: of the one next to it, scarcely any part is visible, the head being broken off, and the body covered with sand to above the shoulders; of the other two, the bonnets only appear. They do not front the river, like those of the temple just described, but are turned with their faces due north, toward the more fertile climes of Egypt; so that the line on which they stand forms an angle with the course of the stream. The head, which is above the surface, has a most expressive youthful countenance, approaching nearer to the Grecian model of beauty than that of any ancient Egyptian figure I have seen: indeed, were it not for a thin oblong beard, it might well pass for a head of Pallas. This statue wears the high bonnet, usually called the corn-measure, in the front of which is a projection bearing the figure of a Nilometer: the same is upon the bonnets of the other two. The arms are covered with hieroglyphics deeply cut in the sand-stone, and well executed. The statue measures seven yards across the shoulders, and cannot, therefore, if in an upright posture, be less than from sixty-five to seventy feet in height." On being uncovered, they have been discovered to be in a sitting posture; and their height is fifty-one feet, not including the head-dress, which is fourteen feet more.

The information and conjectures of Mr. Burckhardt determined Mr. Salt to engage the services of Belzoni, in attempting to clear and open the temple. The difficulty of the enterprise obliged him to desist in his first attempt, after he had uncovered about twenty feet of the front of the temple. "The amazing accumulation of sand," he says, "was such, that it appeared an impossibility ever to reach the door. We ascended a hill of sand at the upper part of the temple, and there found the head of a hawk projecting out of the sand, only to its neck. From the situation of this figure, I concluded it to be over the door; and, from the size of the head, that it must be more than twenty feet high; so that, with the cornice and frieze, I calculated that the door-way could not be less than thirty-five feet below the surface of the sand." This was towards the end of September, 1816. After having been joined at Philæ, the following June, by Captains Irby and Mangles, and Mr. William Beechey, Belzoni again ascended to Ybsambul, and, on the eleventh of July, they renewed the operations. After encountering many difficulties and vexations, on the thirty-first of July they discovered the upper part of the door, and on the first of August entered the temple, having made a passage sufficiently wide to admit them.

The exterior front of this vast excavation he found to be one hundred and seventeen feet in length. From the upper cornice to the base, its height is eighty-six feet and six inches. The entrance, which is nearly in the centre, is surmounted with a frieze, torus, and cornice, with the figure of the hawk-headed deity over it, which is twenty feet high, and is receiving offerings from two female figures on each side; these are represented on the level surface of the rock, and are surrounded with hieroglyphics. Below, on the left hand, is a small statue of Isis, and on the right that of a terminal wolf. A moulding runs round the top of the temple and down the sides. Four tablets of hieroglyphics above, answer to the four statues. Over these is a row of monkeys, twenty-two in number, and about eight feet high. The four colossal statues are cut out of the solid rock, and under the arm of one of them may be seen traces of the stucco with which they appear to have been covered: traces of red paint are discernible in several places.

The interior consists of no fewer than fourteen chambers, together extending a hundred and fifty-four feet in length. The entrance-door leads into a spacious hall, fifty-seven feet by fifty-two, whose roof appears to have been supported by a double row of colossal statues, thirty feet high, the tops of their head-dresses reaching to the ceiling. Their size, magnified by the dimness that surrounds them, has an almost overwhelming effect. They are finely executed, and appear to represent Osiris, with his legs crossed, and holding in one hand the scourge, and in the other the crosier, or *tau*. The square pillars to which they are attached are five feet and a half square, and, as well as the walls, are covered with beautiful hieroglyphics and bold sculptural representations. The colouring appears to have been originally exceedingly beautiful, but it has been materially injured by the extreme heat and closeness of the apartments, occasioned by the want of a free circulation of air. Belzoni supposes the heat to be as high as 130° of Fahrenheit. On each side of the door, behind the columns, is a battle scene, in which the gigantic hero, in his war-chariot, is destroying his enemies with his arrows. The designs resemble those of the sculptures at Medinet Habou, comprising the storming of castles, processions of prisoners, sacrifices, &c.; and the hero appears to be the same personage, but the vanquished seem to be of different nations, some of them being perfectly black, with all the characteristics of the negroes of the interior, while others bear a strong resemblance to the modern Nubian. Their dress, which is generally the skin of the leopard or tiger, shows that they are intended for savage tribes.

The second hall is a kind of antechamber, thirty-seven feet by twenty-five, containing four pillars, each about four feet square: its walls are covered with hieroglyphics in tolerable preservation. Beyond this is a long narrow chamber, thirty-seven feet by ten, which contains the entrance to the adytum. At each end of this chamber a door leads into a small side-room, eight feet by seven, running in the same direction as the sanctuary, which is an apartment, twenty-three feet and a half by twelve, containing an altar in the centre. At the upper end of this sanctuary are four colossal sitting figures, about eight feet high, in good preservation. The first to the right hand is the hawk-headed deity. The second is a beardless figure, with a casque somewhat resembling that given to Minerva. The third is bearded, and has a tall head-dress, which resembles the *tutulus*. The fourth is bearded and bareheaded. Belzoni found also several detached statues, which he carried away with him.

The remaining eight chambers are side-apartments, two running out on each side of the second hall, from an intermediate vestibule, and two from the right-hand side of the entrance-chamber: the first of these has never been finished, and there are none on the corresponding side. Around them are benches, which appear to have been designed as seats, though they may have been intended to answer some other purpose. A light black substance, supposed to be decayed wood, was found in every apartment, in some places to the depth of two feet. Many small pieces of wood were strewed about, which, when they were touched, crumbled into dust. The wooden pivots for the doors still remained in the upper corner of each of the entrances, and one broken brass socket was found, which had been designed to receive the pivot of a hinge. Such are the remains, which Sir F. Henniker justly styles, "the noblest monument of antiquity that is to be found on the banks of the Nile." In our plate TEMPLE, *fig.* 9, is a plan of this temple.

YEW-TREE, (*taxus.*) Yew-trees are remarkable for their duration. At Fountain's Abbey, in Yorkshire, are seven very large yew-trees, commonly called the Seven Sisters, which were standing, according to the current tradition, in 1088. When the great abbey was building, which was finished in 1283, the masons are said to have worked their stones under the shade of these trees. On measurement, their respective circumferences were found to be as follows:—the smallest tree, round its body, five yards one foot; four others, from five yards and a half to seven yards and a half; the sixth, nine yards and a half; and the seventh, eleven yards one foot seven inches, in circumference, being two yards ten inches larger than the great yew-tree in the church-yard of Gresford, in North Wales, which is nine yards nine inches.

YORK CATHEDRAL. The see of York owes its origin to Edwin, the Saxon king of Northumbria, who, in the early part of the seventh century, married Ethelburga, the sister of Ebald, king of Kent, and daughter of Ethelbert, the first Christian king of that district. Edwin was baptized at York, on Easter-day, April 12, 627, and laid the foundation of the cathedral, which was at first, according to Bede, a wooden building. The king soon afterwards commenced a regular and appropriate church of stone, which was intended to enclose and protect the former, but he did not live to see it completed. It was completed, of a quadrangular form, by Oswald, before 642. Wilfred, appointed to this see in 669, found it in a state of rapid decay: Eddius, who wrote about 720, says, that the timbers of the roof were rotten, the walls decayed, the windows destitute of glass, whereby the interior parts were exposed to the injuries of the weather; the whole edifice having been left to the birds of the air for an undisturbed residence. Wilfred strengthened the walls, renewed the wood-work of the roof, and covered it with lead, glazed the windows, which, according to William of Malmsbury, had been originally furnished only with linen curtains and lattices of wood, and white-washed the walls. Wilfred's cathedral was destroyed by fire in 741, and archbishop Egbert, a few years afterwards, commenced the erection of a new church, which was finished by his successor Albert. Alcuin (de Pontif.) describes this as a lofty building, supported by arches and columns, with large windows and vaulted roof, and containing porticos and galleries—

"Hæc nimis alta domus solidis suffulta columnis
Suppositæ quæ stant curvatis arcubus, intus
Emicat egregiis laquearibus atque fenestris;
Pulchraque porticibus fulget circumdata multis,
Plurima diversis retinens solaria tectis
Quæ triginta tenent variis ornatibus aras."

When, in 1069, the Danes were invited by the Northumbrians to assist them in throwing off the yoke of the Norman conqueror, in the contest which ensued, the cathedral was again destroyed by fire. It was rebuilt by archbishop Thomas, soon after; but, in 1137, it was once more destroyed by an accidental fire, and its re-erection was not commenced till the time of archbishop Roger, in 1171, who built the choir with its vaults. Archbishop Walter Grey, in 1227, erected the south transept, and, in 1260, John le Romayne, treasurer of the church, completed the north transept, and erected a handsome tower, or steeple, in the place now occupied by the great lantern tower. His son, archbishop John le Romayne, laid the foundation of the nave, April 7, 1291, which was finished about forty years after by his successor William de Melton. The materials for building the nave were furnished by Robert de Vavasour, who granted the use of his quarry, near Tadcaster, for the purpose; and by Robert de Percy, lord of Bolton, who gave his wood at Bolton to furnish timber for the roof, &c.

In 1352, archbishop John Thoresby pulled down the work of archbishop Roger, and erected in its place the present choir, and also took down the old central tower, which had been erected by John le Romayne, and substituted in its place the elegant lantern tower in the centre of the edifice. The rest of the structure, except the towers at the west-end, were finished between 1405 and 1426. The western towers appear to have been erected by John de Birmingham, about 1402. The chapter-house is attributed to archbishop Walter Grey; but is, according to Mr. Britton, evidently posterior to his time. The vestry was anciently a chapel, and was founded by archbishop Zouch, about the year 1350.

In magnitude and architectural beauty, the cathedral of York has generally been considered to take nearly the first rank among the architectural edifices of England. It is very nearly regular in its arrangement and style of architecture. The whole edifice consists internally of a nave with its two aisles, a transept with two aisles and a lantern in the centre, a choir and lady chapel with two aisles, vestries, a chapel on the south side, and a chapter-room with a vestibule on the north side.

The west front is formed by two uniform towers, strengthened by buttresses at their corners, diminishing at four divisions as they ascend, and rising from the western ends of the aisles of the nave; between them rises the front of the middle aisle to the same height as its side walls, and an open battlement runs across the whole breadth, round the towers, continuing along the sides of the nave. The whole front is covered with rich sculpture, and adorned with a number of niches, wrought into the wall and the buttresses. The grand window in the middle division is a splendid example of the leafy tracery that marks the style of the middle of the fourteenth century. The door-way, which is comparatively of small dimensions, is divided by a slender pillar into two smaller arches, above which is a circular glazed compartment, ornamented by tracery. The double buttresses at each angle diminish in their breaks, and are finished elegantly with crochets, &c. Above the cornice, which runs entirely round the towers, even at the angles, rise eight lofty square pinnacles, and a high and elaborate battlement. The walls of the upper portion of the towers are beautifully adorned with pinnacles, gables, niches, &c.

The nave, which consists of two stories, is divided by buttresses into seven parts. The north side is plain, and the broad and massive buttresses of the aisle have no pinnacles: and the once lofty pinnacles of the south aisle are so much decayed, as to display only shapeless fragments. The central tower is in the Tudor style: each of its four sides has two large windows, with two tiers of mullions, bounded on each side by compartmented buttresses.

The superb front of the south transept, which was completed in the reign of Henry III., is divided into three parts by buttresses, the central compartment containing the porch. The great circular window, over it, consists of two concentric circles of small columns and trefoil arches, with a pierced centre and spandrils. The early date of the erection of the south transept, Mr. Britton observes, "is evinced by its acutely-pointed arches, and slender pillars with plain or slightly ornamented capitals, its narrow and acutely-pointed windows, destitute of mullions, (except in the central window, which is probably a modern insertion,) and its angular pediments; while the octangular turrets and pinnacle of the gable, however rich in the decorations of more modern works, are injurious to the simplicity and harmony of the original design."

In the exterior of the north transept, we see the finished neatness and plainness of the first period of the pointed style; the two lancet lights, in each bay of the aisles, being divided by slender buttresses, neatly canted at the angles, and with mouldings. Under the five long single lights in the north end, runs a series of arches with trefoil heads. Each of the clerestory windows of the exterior of the choir is inserted in the inner part of the wall, and has an open screen before it. The east end of the building is extremely beautiful, the outline formed by four pinnacles, very lofty, rising from the buttresses, and finished with an open crown, out of which rise the crocheted spires. Over the centre and aisles are open worked parapets, and the centre is occupied by a square turret. The buttresses are adorned with pedestals, canopies, and niches; but all the statues which formerly filled them, except three, have been destroyed.

In the interior of the transept the early pointed style prevails;

but the style is very irregular, presenting cloistered detached columns with bands, bases with deep and bold members, and capitals richly and fancifully sculptured. The arches have heads both acute and obtuse, some nearly circular. The roof of the transept is of wood, arched and adorned with ribs and knots, in imitation of those of the nave and choir. The chapter-house is entered from the north-east corner of the transept, by a door-way of singular form and ornament. In the eastern part of the transept, the capitals of the columns, the brackets, mouldings of arches, &c. are all most elaborately sculptured. The south transept is not so regular or so well finished as the opposite, though its middle story is rather richer in detail.

The pillars of the nave are remarkably plain, consisting of three-quarter shafts, larger and smaller alternately, attached to a solid pier; part of them rises up to the springing of the groined roof, while the others support the vaulting of the aisles, and the principal side arches. The bases and capitals are simple and flat. Over each of the principal arches is a window, containing in its breadth five lights, between which and the arch is a triforium, consisting of five openings between mullions, with trefoil heads and acute pediments.

The aisles are very lofty and grand. The wall, below the windows, is adorned with panelling and tracery, with crocheted gables, divided by pinnacles, a mode of decoration which began about the time of Edward I. The arches of the great tower, or lantern, are supported by vast clustered piers; and its gallery is at once simple and elegant. Between the nave and the choir is a gorgeous stone screen, covered with a superabundance of niches, canopies, brackets, and other architectural ornaments. Near its centre is the arched entrance to the choir, the exterior moulding of an ógee shape, terminating in a rich finial. The following is Mr. Britton's description of the choir:—

"After passing through the screen just described, the visitor is introduced to the choir, which is grand in scale, and rich in adornment. On each side is a series of twenty stalls, with twelve at the west end, beneath the organ. These are of oak, and are peculiarly rich in their canopies and carved decorations. Each seat, or stall, has its moveable misericordia, with projecting rests for the elbows, from which rise two detached slender columns, supporting an elaborate canopy. The style and character of these stalls are delineated in Plate XXIII. and in Plate XXIV. [of his 'History and Antiquities of York Cathedral.'] The former plate also displays the general architecture and fitting up of the choir, with the cathedral or archbishop's throne on the south side, built in 1740, and the pulpit opposite. Both of these are of modern workmanship, and do not harmonize with the stalls. At the èastern end of the choir is the altar table, raised above the regular floor, by a series of fifteen steps. Behind it is a handsome screen, with mullions, tracery, a parapet, &c. Its open days, or lights, are filled with plate glass, which affords a view of the elegant eastern window. The architectural character of this screen is shown in the plate of the choir above referred to, and one compartment of it is delineated in Plate XXIV.

"The little transept, as we must call it for distinction's sake, was a fine contrivance of the architect. Standing against the pulpit, or on the opposite side, its effect is un-commonly beautiful. The lines of the sides become diversified, without breaking off; and the interior, with the lofty windows at each end and the sides, are peculiarly elegant.

"Behind the stalls of the choir are closets, some of which are used as vestries by the singing men; modern staircases have been constructed, leading to the galleries erected above, and which disfigure the view into the aisles. These closets are fronted, next the aisles, by open screens of oak, some of which are of excellent carving, and more elaborate than others. In the centre of the choir stands a desk for the vicars-choral to chant the litany in; it is enclosed in a pew of carved wood. The brazen eagle-stand is modern. Its pillar is not elegantly formed, and the position, at one side of the choir, is not so well chosen as if placed in the centre.

"There were anciently three altars in the choir, viz. St. Stephen's, our Lady's, and the high altar in the centre. On each side of the latter was a door-way to the apartment between the screens, where the archbishop used, on solemn festivals, to put on some of his robes; and which was sometimes improperly styled the 'Sanctum Sanctorum' here, as in other places.

"The roof of the choir is of a loftier pitch than that of the nave, and is actually higher by some feet. The ribs are also more numerous, and cross each other in angular compartments: from their number, however, they take off the leading distinction of the main ribs.

"The walls in the aisles are panelled with mouldings, which partly correspond with the windows. Niches fill up the spaces between the windows and pilasters. The gallery over the great arches is rather injured by the height of its openings, being divided by a stone rail. The open gallery beneath the clerestory windows, and forming a part of each, is richer than that in the nave: each division being crowned by a curved canopy, finished with crochets. The aisles are groined in the simple style of the nave. The eastern bay is the narrowest."

The window at the east end is exceedingly splendid, and nearly corresponds with the choir in height and breadth. The outer rim of the arch is wrought into little tabernacles filled with half-length figures, and the soffit of the arch has a series of canopies running up to the crown of it, each occupied by a projecting bust. On the glass is represented nearly two hundred historical subjects. The heads of the figures are most beautifully drawn.

On the south side of the choir are three chapels or vestries. The crypt, beneath the altar, is entered by eight steps from the aisles of the choir. It has four aisles, each of three arches, supported by short columns, five feet six inches high. The side piers, or half columns, are octagonal, with capitals of more modern and plainer work. Six round columns in it have ancient capitals. The interior of the chapter-house, which is entered from the north transept, is of large dimension, and of an octagonal form. On seven of its sides are fine arched windows. Its vestibule is peculiarly interesting in its sculptural and architectural decorations.

On the second of February, 1829, this grand edifice again became a prey to the flames. The following account of this disaster, the work of an incendiary, is given in the Gentleman's Magazine.

"Feb. 2.—The interior of that stupendous monument of past ages, York Minster, was nearly destroyed by fire. It was discovered about seven o'clock in the morning, when nearly the whole of the woodwork of the choir was in flames, which were soon communicated to the organ, and in about an hour they reached the roof, which was soon in a blaze. The spectacle at nine o'clock was awful. The interior of the vast building was a mass of fire, glowing with the most intense heat, and reflected upon the beautiful stained glass. Great fears were entertained for the east window, but the approach of the fire was stopped by sawing asunder the beams of the roof, and pushing the rafters into the burning abyss. The flames raged furiously, until the roof had fallen in, and about twelve o'clock all fears of their extending themselves had vanished, but the engines continued to play throughout the day, and the night following. They were unable to reach the roof, owing to its height, otherwise they might have been more serviceable. The damage may be summed up thus: the roof of the choir quite gone, the wood-work on each side consumed, the organ entirely destroyed, many monuments broken, and the communion plate melted. On the other hand, the east window is entire, the screen uninjured, although immediately below the organ; the records in the vestry, the horn of Ulphus, the coronation chair, and the brass eagle, are saved, and the wills in the Prerogative-office are in safety. The portion of the roof which has fallen is two hundred and twenty-two feet in length; and to restore the Minster to its recent state, £80,000 will probably be required." A public subscription was made, to repair the Minster, and a large sum collected. Various plans have been suggested for the repairs.

Z.

Zacco, or *Zaccho*, (Ital.) the same as *Zocle*.

Zeta, or *Zeticula*, (Gr.) a small withdrawing chamber; a stove-room; a parlour. In churches, the zeta was a room in which the church-keeper or sexton lived. Formerly this room was built over the porchway and entrance into the church. The sexton here kept his books, and gave his returns as custom enforced, and in the zeta all parochial business was settled.

Zocle, *Socle*, or *Zocco*, a term given to a low square member, used instead of a pedestal, to support a column. When a zocle runs round a building, it is termed a *continued zocle*. A *zocle* differs from a pedestal in being without base or cornice. See *Plinth*.

Zodiac, (Gr. ζωδιακος, *containing living creatures*, from ζωη, *to live*.) There are still existing a number of monuments which are decorated with a figure of the zodiac. One of the most curious is that termed the *rustic calendar*, and the *Farnese calendar*, as belonging to the villa Farnese. It is a square marble, each of its faces containing three signs of the zodiac, and three columns on which are engraved the names of the months, and of their presiding deities, and also the length of the hours, both equinoxial and natural, of the day and night. This marble served as the base to a solar dial. The plates 16, and 16 *a* and *b* of the Monumenti Gabini, represent a circular monument consisting of a portion of a fluted column, surmounted by a disc of Pentelic marble. The horizontal surface is surrounded by a band, on which are sculptured twelve small busts. The perpendicular band, which is represented in plate 16 *b* of that work, has the twelve signs of the zodiac, and after each sign is represented a symbolical figure, generally an animal, the emblem of the deity who presides over the corresponding month. Some authors consider this as being the surface of an altar dedicated to the twelve principal gods of the ancient mythology, and they support this opinion by various passages of ancient authors, and by inscriptions. The Farnesian calendar appears also to have been an altar, but of a square form.

On the summit of the nave of the grand temple of Dendera, is a small apartment, part of whose ceiling is occupied by what has been supposed to be a celestial planisphere, a drawing of which is given by M. Denon, in the hundred and thirtieth plate to his "Voyage en Egypte." There, the French savans recognized the twelve signs of the zodiac intermixed with hieroglyphical figures, so ancient as to overturn the chronology of scripture; their wild speculations occasioning so powerful a prepossession in favour of their extreme antiquity, as to lead them to overlook the very obvious proofs of the modern character of the whole edifice. A minute description of the various compartments is given by Mr. Richardson. "To me," he says, "it appears, that without the most unwarrantable supplements, and the greatest distortion of interpretation, it cannot be considered as a zodiac at all. For, first, the number of signs is incomplete; the advocates for the zodiacal interpretation acknowledge this; there is no Crab." And after pointing out the various other discrepancies, the learned traveller concludes, by stating it as his decided opinion, that "the whole is a mythological exhibition of the most interesting objects in the Egyptian theology, without having any reference whatever to astronomy." The representation given of this pretended zodiac, in the splendid work published at Paris, is pronounced to be extremely elegant and extremely incorrect, not in the least degree preserving the style and character of the original, and containing several important variations. This "zodiac" has since been removed, "very skilfully, indeed, but very unfortunately for the appearance of the temple, which was indisputably the best preserved of any in Egypt." It is now at Paris. See *Dendera*.

The custom of placing the signs of the zodiac upon sacred monuments has been continued since the rise of Christianity. A very old example may be seen over one of the side gates of the cathedral of Autun: others are observed at the portals of the cathedrals of Vezelay and of Arras. That at the Parisian church has been described by M. Dupuis; and M. Lalande has given drawings and descriptions of that at the church of Strasburgh, in the "Mémoires de l'Institut National."

ZONE. The following is—

A Table for finding the Areas of the Zones of a Circle, the diameter, which is unity, being divided into 1000 equal parts, and the Heights of the Zones being expressed in decimal parts from .001 to 5. Such a Table is not only useful in finding the Areas of the Zones of Circles, but in finding the Areas of the surfaces of all solids which depend upon expressions similar to such Areas.

Table of Areas of Zones.

Ht.	Area.	Ht.	Area.	Ht.	Area.	Ht.	Area.	Ht.	Area.
.001	.001000	.048	.047927	.095	.094426	.142	.140068	.189	.184398
.002	.002000	.049	.048922	.096	.095407	.143	.141026	.190	.185323
.003	.003000	.050	.049917	.097	.096388	.144	.141984	.191	.186248
.004	.004000	.051	.050912	.098	.097369	.145	.142942	.192	.187172
.005	.005000	.052	.051906	099	.098350	,146	.143898	.193	.188094
.006	.006000	.053	.052901	.100	.099330	.147	.144854	.194	.189016
.007	.007000	.054	.053895	.101	.100309	.148	.145810	.195	.189938
.008	.008000	.055	.054890	.102	.101288	.149	.146765	.196	.190858
.009	009000	.056	.055883	.103	.102267	.150	.147719	.197	.191777
.010	.010000	.057	.056877	.104	.103246	.151	.148673	.198	.192696
.011	.011000	.058	.057870	.105	.104223	.152	.149625	.199	.193614
.012	.011999	.059	.058863	.106	.105201	.153	.150578	.200	.194531
.013	.012999	.060	.059856	.107	.106178	.154	.151530	.201	.195447
.014	.013998	.061	.060849	.108	.107155	.155	.152481	.202	.196362
.015	.014998	.062	.061841	.109	.108131	.156	.153431	.203	.197277
.016	.015997	.063	.062833	.110	.109107	.157	.154381	.204	.198190
.017	.016997	.064	.063825	.111	.110082	.158	.155330	.205	.199103
.018	.017996	.065	.064817	.112	.111057	.159	.156278	.206	.200015
.019	.018996	.066	.065807	.113	.112031	.160	.157226	.207	.200924
.020	.019995	.067	.066799	.114	.113005	.161	.158173	.208	.201835
.021	.020994	.068	.067790	.115	.113978	.162	.159119	.209	.202744
.022	.021993	.069	.068782	.116	.114951	.163	.160065	.210	.203652
.023	.022992	.070	.069771	.117	.115924	.164	.161010	.211	.204559
.024	.023991	.071	.070761	.118	.116896	.165	.161954	.212	.205465
.025	.024990	.072	.071751	.119	.117867	.166	.162898	.213	.206370
.026	.025989	.073	.072740	.120	.118838	.167	.163841	.214	.207274
.027	.026987	.074	.073729	.121	.119809	.168	.164784	.215	.208178
.028	.027986	.075	.074718	.122	.120779	.169	.165725	.216	.209080
.029	.028984	.076	.075707	.123	.121748	.170	.166666	.217	.209981
.030	.029982	.077	.076695	.124	.122717	.171	.167606	.218	.210882
.031	.030980	.078	.077683	.125	.123686	.172	.168549	.219	.211782
.032	.031978	.079	.078670	.126	.124654	.173	.169484	.220	.212680
.033	.032976	.080	.079658	.127	.125621	.174	.170422	.221	.213577
.034	.033974	.081	.080645	.128	.126588	.175	.171359	.222	.214474
.035	.034972	.082	.081631	.129	.127555	.176	.172295	.223	.215369
.036	.035969	.083	.082618	.130	.128521	.177	.173231	.224	.216264
.037	.036967	.084	.083604	.131	.129486	.178	.174166	.225	.217157
.038	.037965	.085	.084589	.132	.130451	.179	.175100	.226	.218050
.039	.038962	.086	.085574	.133	.131415	.180	.176033	.227	.218941
.040	.039958	.087	.086559	.134	.132379	.181	.176966	.228	.219832
.041	.040954	.088	.087544	.135	.133342	.182	.177897	.229	.220721
.042	.041951	.089	.088528	.136	.134304	.183	.178828	.230	.221610
.043	.042947	.090	.089512	.137	.135266	.184	.179759	.231	.222497
.044	.043944	.091	.090496	.138	.136228	.185	.180688	.232	.223354
.045	.044940	.092	.091479	.139	.137189	.186	.181617	.233	.224269
.046	.045935	.093	.092461	.140	.138149	.187	.182545	.234	.225153
.047	.046931	.094	.093444	.141	.139109	.188	.183472	.235	.226036

Ht.	Area.	Ht.	Area.	Ht.	Area.	Ht.	Area.	Ht.	Area.
.236	.226919	.289	.271987	.342	.313050	.395	.348791	.448	.377138
.237	.227800	.290	.272802	.343	.313778	.396	.349403	.449	.377580
.238	.228680	.291	.273616	.344	.314505	.397	.350012	.450	.378018
.239	.229559	.292	.274428	.345	.315230	.398	.350619	.451	.378452
.240	.230439	.293	.275239	.346	.315952	.399	.351223	.452	.378881
.241	.231313	.294	.276049	.347	.316673	.400	.351824	.453	.379307
.242	.232189	.295	.276857	.348	.317393	.401	.352423	.454	.379728
.243	.233063	.296	.277664	.349	.318110	.402	.353019	.455	.380145
.244	.233937	.297	.278469	.350	.318825	.403	.353612	.456	.380557
.245	.234809	.298	.279273	.351	.319538	.404	.354202	.457	.380965
.246	.235680	.299	.280075	.352	.320249	.405	.354790	.458	.381369
.247	.236550	.300	.280876	.353	.320958	.406	.355376	.459	.381768
.248	.237419	.301	.281675	.354	.321666	.407	.355958	.460	.382162
.249	.238287	.302	.282473	.355	.322371	.408	.356537	.461	.382551
.250	.239153	.303	.283269	.356	.323075	.409	.357114	.462	.382936
.251	.240019	.304	.284063	.357	.323775	.410	.357688	.463	.383316
.252	.240883	.305	.284857	.358	.324474	.411	.358258	.464	.383691
.253	.241746	.306	.285648	.359	.325171	.412	.358827	.465	.384061
.254	.242608	.307	.286438	.360	.325866	.413	.359392	.466	.384426
.255	.243469	.308	.287227	.361	.326559	.414	.359954	.467	.384786
.256	.244328	.309	.288014	.362	.327250	.415	.360513	.468	.385141
.257	.245187	.310	.288799	.363	.327939	.416	.361070	.469	.385490
.258	.246044	.311	.289583	.364	.328625	.417	.361623	.470	.385834
.259	.246900	.312	.290365	.365	.329310	.418	.362173	.471	.386172
.260	.247755	.313	.291146	.366	.329992	.419	.362720	.472	.386505
.261	.248608	.314	.291925	.367	.330673	.420	.363264	.473	.386832
.262	.249461	.315	.292702	.368	.331351	.421	.363805	.474	.387153
.263	.250212	.316	.293478	.369	.332027	.422	.364343	.475	.387469
.264	.251162	.317	.294252	.370	.332700	.423	.364878	.476	.387778
.265	.252011	.318	.295025	.371	.333372	.424	.365410	.477	.388081
.266	.252851	.319	.295796	.372	.334041	.425	.365939	.478	.388377
.267	.253704	.320	.296565	.373	.334708	.426	.366463	.479	.388669
.268	.254549	.321	.297333	.374	.335273	.427	.366985	.480	.388951
.269	.255392	.322	.298098	.375	.336636	.428	.367504	.481	.389228
.270	.256235	.323	.298863	.376	.336696	.429	.368019	.482	.389497
.271	.257075	.324	.299625	.377	.337354	.430	.368531	.483	.389759
.272	.257915	.325	.300386	.378	.338010	.431	.369040	.484	.390014
.273	.258754	.326	.301145	.379	.338663	.432	.369545	.485	.390261
.274	.259591	.327	.301902	.380	.339314	.433	.370047	.486	.390500
.275	.260427	.328	.302658	.381	.339963	.434	.370545	.487	.390730
.276	.261261	.329	.303412	.382	.340609	.435	.371040	.488	.390953
.277	.262094	.330	.304164	.383	.341253	.436	.371531	.489	.391166
.278	.262926	.331	.304914	.384	.341895	.437	.372019	.490	.391370
.279	.263757	.332	.305663	.385	.342534	.438	.372503	.491	.391564
.280	.264586	.333	.306410	.386	.343171	.439	.372983	.492	.391748
.281	.265414	.334	.307155	.387	.343805	.440	.373460	.493	.391920
.282	.266240	.335	.307898	.388	.344437	.441	.373933	.494	.392081
.283	.267065	.336	.308640	.389	.345067	.442	.374403	.495	.392229
.284	.267889	.337	.309379	.390	.345694	.443	.374868	.496	.392362
.285	.268711	.338	.310117	.391	.346318	.444	.375330	.497	.392480
.286	.269532	.339	.310853	.392	.346940	.445	.375788	.498	.392580
.287	.270352	.340	.311588	.393	.347560	.446	.376242	.499	.392657
.288	.271170	.341	.312319	.394	.348177	.447	.376692	.500	.392699

Zophorus, (Gr. from *ζοον*, an animal, and *φερω*, to bear,) a name given by the Greeks to the frieze, because it was covered in general with figures of animals, &c. See *Frieze*.

Zotheca, (from the Greek,) a small room or alcove, which might be added to, or separated from, the room to which it adjoined, by means of curtains and windows. Pliny mentions them in his description of his Laurentine villa: see the article *Villa*. See also *Niche*.

APPENDIX.

No. 1.

CHRONOLOGICAL TABLES of the PRINCIPAL ARCHITECTS of different Countries,

BOTH BEFORE AND SINCE THE CHRISTIAN ERA.

[Of those marked thus *, a further account will be found under their proper articles.]

NAME.	COUNTRY.	B.C.	WORKS.
1 Theodorus	Samos	abt. 700	The labyrinth at Lemnos, some buildings at Sparta, and the temple of Juno at Samos.
2 Hermogenes	Alabanda	650	Temple of Bacchus at Teos, and that of Diana at Magnesia.
3 *Agamedes and Trophonius	Delphi	600	Temple of Apollo at Delphi; a temple dedicated to Neptune, near Mantinea.
4 Amphion	Thebes	600	Citadel of Thebes.
5 Memnon	Persia	600	A palace for Cyrus at Ecbatana.
6 Chersiphron	Ephesus	600	First temple of the Ephesian Diana.
7 Demetrius	Ephesus	540	Continued the temple of Diana, which had been begun by Chersiphron.
8 Eupalinus	Megara	500	An aqueduct, with many other edifices, at Samos.
9 Mandrocles	Samos	500	The wooden bridge over the Thracian Bosphorus, erected by the command of Darius.
10 Chirosophus	Crete	500	Temple of Ceres and Proserpine, another of the Paphian Venus, and one of Apollo; all at Tegea.
11 *Callicrates	Athens	472	
12 Pythius	Priene	450	Mausoleum of Artemisia in Caria; design for the temple of Pallas at Priene. In the former he was assisted by Statirus.
13 Spintharus	Corinth	450	Rebuilt the temple of Apollo at Delphi, which had been destroyed by fire.
14 Agaptus	Elis	450	Portico at Elis.
15 Libon	Elis	450	Temple of Jupiter Olympius a Olympia.

NAME.	COUNTRY.	B.C.	WORKS.
16 Ictinus	Athens	450	Parthenon at Athens; temple of Ceres and Proserpine at Eleusis; temple of Apollo Epicurius in Arcadia.
17 Callicrates	Athens	450	Assisted Ictinus in the erection of the Parthenon.
18 Mnesicles	Athens	450	Propylæa of the Parthenon.
19 Corabus	Eleusis	450	Cœlesterium at Eleusis.
20 *Antistates	Athens	450	A temple of Jupiter at Athens.
21 *Scopas	Greece	430	One side of the tomb of Mausolus; a column of the temple at Ephesus.
22 Pæonius	Ephesus	420	Completed the temple of Diana at Ephesus.
23 Archias	Corinth	400	Many temples and other edifices at Syracuse.
24 Callias	Aradus	400	Temples, &c. at Rhodes.
25 Argelius		400	Temple of the Ionian Æsculapius.
26 Mnesthes		400	Temple of Apollo at Magnesia.
27 Cleomenes	Athens	359	Plan of the city of Alexandria, in Egypt.
28 *Dinocrates	Macedonia	350	Rebuilt the temple of Diana at Ephesus; built Alexandria; was the author of the proposition to transform mount Athos into a colossal figure.
29 Andronicus	Athens	350	Tower of the winds at Athens.
30 *Callimachus	Corinth	340	Said to be the inventor of the Corinthian order.
31 Epimachus	Athens	300	A storm tower.
32 *Sostratus	Gnidus	300	The pharos of Alexandria.
33 Philo	Athens	300	Enlarged the arsenal and the Piræus at Athens; erected the great theatre which was rebuilt by order of Adrian.
34 Eupolemus	Argos	300	Several temples and a theatre at Argos.
35 Phæax	Agrigentum	200	Various buildings at Agrigentum.
36 Cossutius	Rome	196	Design for the temple of Jupiter Olympius at Athens.
37 Hermodorus	Salamis	100	Temple of Jupiter Stator in the forum at Rome; temple of Mars in the Circus Flaminius.
38 Muzius	Rome	100	Temple of Honour and Virtue near the trophies of Marius at Rome.
39 Valerius	Rome	100	Several amphitheatres with roofs.
40 Batrachus	Laconia	40	These two architects built several temples at Rome. The name of the first (βατραχος) signifies a frog; and that of the latter (σαυρος) a lizard; and they per-
41 Saurus	Laconia	40	

NAME.	COUNTRY.	B. C.	WORKS.
			petuated their names on some of their works by the allegorical representation of these two animals sculptured upon them. The churches of St. Eusebius and of St. Lorenzo-fuori-le-Mura, at Rome, still contain some columns whose pedestals are sculptured with a lizard and a frog.
42 Dexiphanes	Cyprus	40	Rebuilt the pharos at Alexandria, at the command of Cleopatra, the other having fallen down.
43 Cyrus	Rome	35	Architect to Cicero.
44 Postumius	Rome	30	Many works at Rome and Naples.
45 Cocceius Auctus	Rome	30	Grotto of Puzzuoli; grotto of Cumæ, near the lake now called Lago d'Averno.
46 Fussitius	Rome	30	Several buildings at Rome; the first Roman who wrote on architecture.
		A. C.	
47 Vitruvius Pollio	Formiæ	1	A *basilica justiciæ* at Famo. A great writer on architecture.
48 Vitruvius Cerdo	Verona	1	A triumphal arch at Verona.
49 Celer and 50 Severus	Rome	50	Golden house of Nero.
51 Rabirius	Rome	80	Palace of Domitian on mount Palatine.
52 Mustius	Rome	90	A temple of Ceres at Rome.
53 Frontinus	Rome	100	He has left a work on aqueducts.
54 *Apollodorus	Damascus		Forum Trajani at Rome; a bridge over the Danube in Lower Hungary.
55 Lacer	Rome		A bridge over the Tagus in Spain; a temple, now dedicated to San Giuliano.
56 Detrianus	Rome		The Moles Hadriani; the Pons Ælius; now called the Castello and Ponte San Angelo.
57 *Antonius, the Senator	Rome		A pantheon at Epidaurus; the baths of Æsculapius.
58 Nicon	Pergamus	150	Several fine works at Pergamus.
59 Metrodorus	Persia	320	Many buildings in India, and some at Constantinople. The first known Christian architect.
60 *Alipius	Antioch	350	Employed by Julian to lay the foundation of a new temple at Jerusalem.

NAME.	COUNTRY.	A. C.	WORKS.
61 Ciriades	Rome	400	A church and bridge.
62 Sennamar	Arabia	450	Sedir and Khaovarnack, two celebrated palaces in Arabia.
63 Aloisius	Padua	490	Assisted in the erection of the celebrated rotunda at Ravenna, the cupola of which is said to have been of one stone, 38 feet in diameter, and 15 feet thick.
64 St. Germain, bp. of Paris	France	500	The plan of the church of St. Germain at Paris, previously dedicated to St. Vincent; a convent at St. Mans.
65 St. Avitus, bp. of Clermont	France	500	Church of Madonne du Port.
66 St. Agricola, bp. of Chalons	France	500	Cathedral of Chalons, with many other churches in his diocese.
67 Ætherius	Constantinople	550	Part of the imperial palace called Chalcis, at Constantinople.
68 *Anthemius of Tralles	Lydia	550	St. Sophia at Constantinople.
69 Isidorus	Miletus	550	Assisted Anthemius in the erection of the church of St. Sophia.
70 Chryses of Dara	Persia	550	Constructed the celebrated dykes along the Euripus, near Dara, to keep the river in its channel, and to keep out the sea. He was particularly excellent in hydraulic architecture.
71 Isidorus	Byzantium	600	The city of Zenobia, in Syria, was the work of these two architects.
72 Johannes	Miletus	600	
73 Saxulphus, abbot of Peterborough, afterwards made bp. of Lichfield in	England	673	Built the monastery of Medeshampstede, afterwards called Peterborough.
74 Biscopius, Benedict	England	7th cent.	Conventual church of Wearmouth.
75 Egbert, archbp. of York	England	8th cent.	Re-edified York Cathedral.
76 Albert, archbp. of York	England	8th cent.	Completed the building of York cathedral, under Egbert.
77 Eanbald, archbp. of York	England	8th cent.	Superintended the erection of York cathedral under his predecessor, archbishop Albert.
78 Romualdus	France	840	The cathedral of Rheims, the earliest example of Gothic achitecture.
79 Tietland	Switzerland	900	Convent of Einseidela in Switzerland.

NAME.	COUNTRY.	A. C.	WORKS.
80 Tioda	Spain	900	The palace of king Alphonso the Chaste at Oviedo, now the episcopal palace; the churches of St. Salvator, St. Michael, and St. Mary.
81 Ednoth, a monk of Worcester	England	974	Superintended the erection of the church and conventual offices of Ramsey abbey.
82 Dunstan, archbp. of Canterbury	England	died 988	Built for himself a cell at Glastonbury abbey, and was skilful in mechanics.
83 Ælfric, bp. of Crediton	England	close 10th cent.	Built part of Malmsbury abbey church, in the reign of Edgar.
84 Elphege, bp. of Winchester	England	died 1006	Crypts of Winchester cathedral.
85 Buschetto of Dulichium	Of Greek extraction.	1016	The cathedral or duomo of Pisa, the earliest example of the Lombard ecclesiastical style of architecture. It was built in 1016.
86 Aldhun, bp. of Durham	England	died 1018	First cathedral church at Durham.
87 Pietro di Ustamber	Spain	1020	Cathedral of Chartres.
88 Aldred, bp. of Worcester	England	1046	

ARCHITECTS *contemporary with, and posterior to, the Conquest of England by the Normans.*

[B, at the head of the Col. stands for *born*—D for *died*—FL for *flourished.*]

NAME.	COUNTRY	B.	D.	FL.	WORKS.
89 Alvaro Garria of Estella in Navarre	Spain			1070	
90 Lanfranc, archbishop of Canterbury	England		1089		Choir of Canterbury catheral, which was burnt in 1174.
91 Remigius, bishop of Lincoln	England		1092		Part of Lincoln cathedral.
92 Karilepho, bishop of Durham	England		1095		Began the cathedral church of Durham, on a plan which he had brought with him from France, when he was abbot of St. Vincent's in Normandy.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
93 Walkelyn, bishop of Winchester	England		1097		Said to have erected the oldest parts of Winchester cathedral.
94 Harlewin, abbot of Glastonbury	England			1097	Rebuilt the abbey church of Glastonbury.
95 Mauritius, bishop of London	England		1107		Built old St. Paul's, in 1083.
96 Gundulf, bishop of Rochester	England		1108		Rochester Castle, — White Tower, in the Tower of London; rebuilt Rochester cathedral.
97 Odo, prior of Croyland	England			1113	Monastic Church of Croyland. Arnold, a lay brother of the abbey, was employed under Odo as mason.
98 Ernulf, bishop of Rochester	England			1115 to 1125	Completed Gundulf's works at Rochester.
99 Alexander, bishop of Lincoln	England			1123 to 1147	Rebuilt Lincoln cathedral.
100 Ranulf, or Ralf Flambard, bishop of Durham	England		1128		Part of Durham cathedral—Norham castle.
101 Henry of Blois, bishop of Winchester	England			1129 to 1169	A most celebrated architect; he built the conventual churches of St. Cross and Rumsey, in Hampshire.
102 Malverne, Alduin de	England			Hen. I.	Architect or surveyor of the works of a bridge over the Wye at Hereford.
103 Raimond of Montfort	France			1139	The cathedral of Lugo.
104 Roger, bp. of Sarum	England		1139		Castles at Sherborn and Devizes; supposed to have built Malmsbury abbey.
105 Dioti Salvi	Italy			1150	The Battisterio of Pisa, near the Campo Santa. His works were in the Lombard style, and were overloaded with minute ornaments.
106 Buono	Venice			1150	The tower of St. Mark at Venice, which is 330 feet high, and 40 feet square, built in 1154; a design for enlarging the church of Santa Maria Maggiore at

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					Florence, of which the master walls still exist; the Vicaria and the Castello del' Uovo at Naples; the church of St. Andrew at Pistola la Casa della Città; a campanile at Arezzo.
107 Sugger of St. Denis	France			1150	Rebuilt the church and abbey of St. Denis, near Paris. He was distinguished by his perfection in the Gothic style.
108 Roger, archbishop of York	England			1154 to 1181	None of his works at his cathedral are now remaining.
109 Pietro di Cozzo da Limena	Italy			1170	The celebrated great hall at Padua, which is 256 feet long, 86 wide, and 72 high, built in 1172, burnt in 1420, and restored by two Venetian architects, Rizzo and Piccino; it was dismantled by a whirlwind in 1756, and again restored by Ferracina.
110 Wilhelm, or Guglielmo	Germany			1170	The hanging tower at Pisa, built in 1174. Bonnano and Thomaso, two sculptors of Pisa, were also engaged upon it.
111 William of Sens	England			1175	Canterbury cathedral.
112 Sisseverne, monk of St. Alban's	England			12th cent.	St. Alban's abbey church.
113 Goldclif, Hugo de	England			12th cent.	An architect of St. Alban's.
114 Eversolt, Gilbert de	England			12th cent	An architect of St. Alban's abbey.
115 Baldwin, abp. of Canterbury	England		1190		Church at Hackington, near Canterbury, and another at Lambeth.
116 Isembert of Xaintes	France			1201	Bridges of Xaintes and Rochelle.—Recommended by king John to the citizens of London, as a proper person to finish London bridge, begun by Peter of Colechurch.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
117 Ebor, J. de, abbot of Fountains	England			1293 to 1209	Began the abbey church there.
118* Peter of Colechurch	England		1205		Began London bridge.
119 Berham, E. de, canon of Salisbury	England			1209	Overseer of the works of Salisbury cathedral, under John and Henry III. Lord Orford supposes him to have been the same person who is called Elyas the engineer, in a record of the reign of king John, relating to the repair of the king's houses at Westminster in 1209.
120 Odo Aurifaber, or the Goldsmith	England			Hen. III.	Clerk of the works at Westminster.
121 Fitz-Odo, Edw.	England				Master of the works at Westminster, under Henry III.
122 Eustachius, bp. of Ely	England		1215		Gallery of Ely cathedral.
123 Robert of Lusarche	France			1220	The cathedral of Amiens, which was continued by Thomas de Cormont, and finished by his son Renauld.
124 Etienne de Bonneveil	France			1220	The church of the Trinity at Upsal in Sweden, built after the model of that of Notre Dame at Paris.
125 Poore, bp. of Salisbury	England		1237		Began Salisbury cathedral.
126 Melsonby, bishop of Durham	England			1237	Part of cathedral of Durham.
127 Hoo, W. de, prior of Rochester	England			1239	Choir of Rochester cathedral.
128 Jean d' Echelles	France			1250	The portico of the cathedral of Notre Dame at Paris.
129 Pierre de Montereau	France			1250	The holy chapel at Vincennes; the refectory, dormitory, chapter-house, and chapel of Notre Dame, in the convent of St. Germain des Prez, near Paris.
130 Eudo de Montreuil	France			1250	The church of the Hotel Dieu at Paris; the churches of St. Catherine du Val des

NAME.	COUNTRY.	B.	D.	FL.	WORKS.
					Ecoliers, of St. Croix de la Bretonnerie, of Blancs Manteaux, of the Mathurins, of the Cordeliers, and of the Carthusians at Paris. His style was dark and heavy.
131 San Gonsalvo	Portugal			1250	Stone bridge at Tui.
131' San Pietro	Portugal			1250	Stone bridge called Il Ponte de Cavez.
132 Lapo, or Jacobus	Germany			1250	Convent and church of St. Francisco; Palazzo del Bargello; and the façade of the archbishop's palace at Florence.
133 Nicola da Pisa	Pisa			1250	Convent and church of the Dominicans at Bologna; church of St. Micheli, some palaces, and the octagonal campanile of the Augustins, at Pisa; the great church del Santo at Padua; the church of Santa Maria at Orvietto; church de' Fratri Minori at Venice; abbey and church in the plains of Taliacozzo, in the kingdom of Naples, built as a memorial of the victory obtained there by Charles I. over Conrad; plans of the church of St. Giovanni at Sienna, of the church and convent della Santissima Trinita at Florence, and of those of the Dominicans at Arezzo, which were built by Maglione his scholar; the repairs and alterations to the duomo at Volterra; the church and convent of the Dominicans at Viterbo. He intermixed the Gothic with the Lombard style.
134 Fuccio	Italy			1270	Church of St. Maria sul' Arno at Florence; the gates against the river Volturno at Capua; he finished the Vicaria and Castello del' Uovo, at Naples, which were commenced by Buono;

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					he was distinguished for his skill in fortification.
135 Ferrante Maglione, disciple of Nicola	Pisa			1270	Cathedral and church of St. Lorenzo at Naples; the Palazzo Vecchio at Naples, in conjunction with Giovanni Benin Casa; the church and convent of the Dominicans at Arezzo.
136 Masuccio	Naples	1230	1305		Church of Santa Maria della Nuovo at Naples; churches of S. Dominico Maggiore and S. Giovanni Maggiore; the archiepiscopal palace, and Palazzo Colombrano, at Naples.
137 Marino Boccanera	Genoa			1280 to 1300	The mole, arsenal, and harbour of Genoa were designed and begun by him.
138 Arnolfo Fiorentino	Florence	1232	1300		The church of S. Croce at Florence; the walls of the city, with the towers; the Palazzo della Signoria, now called Il Palazzo Vecchia; the model and plan of the cathedral of S. Maria del Fiore, to which the cupola was added by Bruneleschi; the abbey, and the Piazza San Micheli; the Piazza dei Priori. His works were greatly admired.
139 Pietro Perez	Spain			1280	The cathedral of Toledo.
140 Robert de Covey	France			1280	Rebuilt the cathedral at Rheims.
141 Erwin von Steinbach	Germany			1280	The celebrated minster of Strasburg was superintended by him for twenty-eight years.
142 Giovanni da Pisa	Pisa			1220 to 1280	The Campo Santo, or public cemetery, at Pisa; the tribune of the Duomo in the same city; Castel Nuovo, and the church of Santa Maria della Nuovo, at Naples; the façade of the cathedral at Sienna; many churches and palaces at Arezzo and other towns in Italy. He was the first architect in the modern

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					style of fortification, and his churches and other buildings are grand and cheerful. He was the son and scholar of Nicola da Pisa.
143 *Andrea da Pisa	Pisa	1270	1345		Plan of the fortress della Scarperia at Mugello, at the foot of the Appenines; plan and model of the church of San Giovanni at Pistoja; the ducal Palazzo Gualtieri at Florence. He was distinguished in fortification.
[illegible] Henry de Ellerton	England			Ed.I.	Master Mason of Caernarvon castle.
145 *Agostino da Siena, or da Pisa	Italy			1300	The north and west façades of the cathedral of Siena, as also the two gates; the church and convent of St. Francis; the Palazzo de' Nove Magistrati; the grand fountain in the piazza opposite the Palazzo della Signoria; the hall of the council chamber, and the Palazzo publico: the church di Santa Maria in Piazza Manetti was built by him, in conjunction with Angelo da Pisa, who was his brother.
146 *Angelo, his brother	Italy				
147 Boyden, William	England			1308 to 1326	Chief architect to the chapel of the Virgin at St. Alban's abbey church, which was erected during the abbacy of Hugo de Eversden.
148 Bek, A. de, bishop of Durham	England		1310		Built and enlarged Barnard castle, and other fortresses.
149 Henry Latomus, or the Stonecutter, abbot of Evesham	England		1319		Chapter-house, Dormitory, Refectory, Abbot's-hall, and kitchen of the monastery at Evesham.
150 Helpstone, J.	England			1322	The New Tower, or Water-Tower, in the walls of Chester.
151 Eversden, Hugh de, abbot of St. Alban's	England		1326		The Lady Chapel in St. Alban's abbey church.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
152 Walter Weston	England			1330	St. Stephen's chapel.
153 Thomas of Canterbury	England			1330	St. Stephen's Chapel, Westminster.
154 Giacoma Lanfrani	Italy			1330	Church of St. Francis at Imola; church of St. Antonio at Venice.
155 Jean Rauy	France			1340	Finished the building of the church of Notre Dame at Paris.
156 Lincoln, J. de	England			1350	Master of the works in the king's chapel in the palace of Westminster.
157 William of Wykeham bishop of Winchester	England			1350	New College, Oxford; part of Winchester cathedral; plan of Windsor Castle.
158 *Calendario	Venice			1354	The porticoes around the place St. Mark.
159 Walsingham, prior of Ely	England		1363		Lantern tower and choir of Ely cathedral. — "Artificiosus frater." Leland.
160 Rede, bp. of Chichester	England			1369	An eminent mathematician—built first library at Merton College, Oxford—Amberly Castle, Sussex.
161 *Andrea di Cione Orgagna	Florence	1329	1389		Additions to the ducal palace at Florence; his brother built the tower and gate of San Pietro Gattolini.
162 Boterell, J.	England			1395	Clerk of the works for the alteration and repair of Westminster Hall, under Richard II.
163 Nich. Walton	England			Rich II.	"Master carpenter and engineer of the king's works for the art of carpentry."
164 Lote Stephen Yevele, or Zevele, H.	England			14th cent.	Monument of Richard II. and his queen, in Westminster Abbey.
165 Gainsborough, or Gaynisburgh	England			14th cent.	An architect employed at Lincoln cathedral. On his monument, still existing in the cathedral, he is said to have died in June, MCCC—, the last portion of the date being obliterated.
166 Chichele, archbp. of Canterbury	England	1362	1443		Founded All Souls' College; built a monument for himself in Canterbury cathedral; made additions to Can-

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					terbury cathedral, Lambeth palace, Croydon church, and Rochester bridge.
167 *Philippo Bruneleschi	Florence	1377	1446		Cupola of the cathedral of Santa Maria del Fiore at Florence. A council of artists was held at Florence in 1420, to consider and advise on this scheme, at which even English artists are said to have assisted: after a diversity of opinions, Bruneleschi's project was approved of and adopted. His other principal works were, the Palazzo Pitti, which was begun and half-finished by him, the remainder being the work of Luca Fancelli; a great part of the church of San Spirito; the church degl' Angeli, designed and begun, but not completed, from want of money; the monastery de' Camaldosi; the fortress of Milan, and several works about that city; a model for the fortress of Pesaro; the old and new citadel at Pisa; some other works there, as well as at Trento, and in other parts of Italy. He drained the country round Mantua. He set the first example of a purer style in the architecture of Italy.
168 Michelozzo Michelozzi	Florence			1400	The Palazzo de Medicis, now dei Marchesi Ricardi; the Palazzo Caffagiulo; the convent of the Dominicans; the Noviziato di Santa Croce; the chapel in the church dei Servi; the Palazzo della Villa Careggi, the Palazzo Tornabuoni, now dei Marchesi Corsi; and several other palaces, churches, and convents at Florence; the monastery of the Black

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					Benedictines at Venice; the Palace di Caffagiuolo, and the Palazzo della Villa Careggi, at Mugello; some buildings at Trento; a beautiful fountain at Assisi; la Citadella Vecchia at Perugia; the alterations to the palace presented by Francisco Sforza to Cosimo di Medici, whom he followed in his exile; other great works in various parts of Italy.
369 Giuliano of Majano,	Near Florence	1377	1447		The Palazzo del Poggio Reale at Naples; a Corinthian triumphal gate at the Castel Nuovo; many fountains in the same city; the Cortile S. Damaso, in the Vatican at Rome, whither he was invited by Paul II.; the palace and church of San Marco at Rome; he also enlarged the church at Loreto.
370 Winferd, W.	England			1403	Master mason to William of Wykeham, at Winchester.
371 Frowcester, Walter, abbot of Gloucester	England		1412		Built the great cloisters of his monastery in 1400.
372 Croyland, William de	England			1417 to 1427	Master of the works at Croyland Abbey, in the time of abbot Upton.
373 Keyes, Roger	England			1422	Architect of All Souls' College, Oxford.
374 Arderne, J.	England				Clerk of the works at the building of the monument of Henry V. in Westminster Abbey, who died in 1422.
375 Horwood, W. a freemason	England			1434	Collegiate chapel of Fotheringhay.
376 Close, or Cloos, bp. of Lichfield	England		1452		Supposed to have designed King's College chapel, Cambridge, though, according to Hearne, his father was the architect.
377 Christobolo	Italy			1450	A mosque at Constantinople, with eight schools, and

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					eight hospitals, on the site of the church of the Apostles, by order of Mahomet II.
179 Baccio Pintelli	Florence			1450	Church and convent of Santa Maria del Popolo at Rome; the celebrated Capella Sistina in the Vatican; the hospital of S. Spirito in Sassia; the Ponte Sisto; designs for the church of San Pietro in Montorio; the church of S. Sisto; the church of San Augostino, and the church of San Pietro, in Vincula, at Rome; he rebuilt the church and convent of St. Francis at Assisi, and built the palace for the cardinal del Rovere at Borgo Vecchio; some attribute to him the palace built for the duke Federigo Feltre at Urbino. He is said to have been the first to set the example of grandeur in the architecture of chapels.
180 Bartolomeo Bramantino	Italy			1450	Church of San Satiro at Milan, and other works in various parts of Italy.
181 Giovanni del Pozz.	Spain			1450	The Dominican convent, and a great bridge over the Huccar, near Cuenza.
182 Andrea Ciccione	Naples		1455		The convent and church of Monte Olivito; the palace of Bartolomeo da Capua; and several other convents and palaces in the city of Naples.
183 Ridolfo Fioravanti	Bologna			1450	Restored the hanging tower of the church of S. Biagio at Cento, to its perpendicular position, and built many churches at Moscow.
184 Orchyarde, W	England			1458	Architect of Magdalen College, Oxford, under bishop Wayneflete.
185 Francesco di Giorgio	Siena	1423	1470		The ducal palace at Urbino.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
186 *Leon Battista Alberti	Florence	1398	1472		Church of St. Francis at Rimini; church of St. Andrew at Mantua; the principal façade of Santa Maria Novella, at Florence, has been attributed by some to Alberti: but Gwilt is of opinion, from the circumstance of its being Gothic, that it may more properly be assigned to Bettini; the gate and Corinthian Loggie are however from the designs of Alberti, as also the Doric façade of the Palazzo Rucellai, and the choir and tribune of the church della Nunziate, all at Florence. He also repaired the Aqua Vergine, and the fountain of Trevi, at Rome, under Nicholas V.; the palace for the duke Federigo Feltre at Urbino; and many other buildings in Italy.
187 Farleigh, or Ferley, W. abbot of Gloucester	England			1472 to 1498	Built the Lady Chapel about 1490.
188 Beauchamp, bishop of Sarum	England		1481		Appointed surveyor of the works at Windsor Castle, by Edward IV.; supposed to have made designs for rebuilding St. George's Chapel; built a chantry chapel in Salisbury cathedral.
189 Wayneflete, bishop of Winchester	England		1486		Founder of Magdalen College, Oxford; overseer of the building at Windsor. Leland was informed that the greatest part of the buildings of Eton College were raised under his direction, and at his expense.
190 Kendale, John	England			Edw. IV.	Supervisor of all the king's works.
191 Essex, John	England			15th cent.	An artist employed on the Beauchamp monument, Warwick.
192 Bourde, John	England			15th cent.	Employed on the Beauchamp monument, Warwick.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
193 Druell, J. archdeacon of Exeter	England			15th cent.	One of the architects employed on All Souls' College, Oxford.
194 *Bramante Lazzari, or Bramante d' Urbino, of Castel Durante,	near Urbino	1444	1514		First designed and commenced the building of St. Peter's, at Rome, in 1513; a small model was executed after the same design for an insulated church without the walls of Todi; many works in the Vatican, particularly the library and the Belvidere court, with a magnificent design for alterations to be made in it, under Julius II.; the rotundo in the convent of San Pietro Montorio; the palaces of S. Giocomo Scoscia Cavalli ora de' Conti Geraud, del Duca de Sora, della Cancellaria, dell Nuovo dell' Imperiale; the churches of S. S. Euloy de' Orfano, Lorenzo, and Damaso; the cloisters of the monastery della Pace, &c. at Rome; the Strada Julia in that city; the ducal palace at Urbino; the Palazzo Publico at Breschia; design for the church dell' Umilta at Pistoja.
195 Francesco Giamberti	Florence			1470	Numerous plans for buildings at Florence and Rome.
196 Ventura Vitoni	Pistoja			1479	The church dell' Umilta at Pistoja, after the design of Bramanti, whose pupil he was.
197 Alcock, J. bishop of Ely	England		1500		A sepulchral chapel in Ely cathedral, episcopal palace at Downham, and supposed to have designed St. Mary's, or the University Church, Cambridge.
198 Moston, J. of Cambridge abp.	England		1500		Part of palace at Lambeth; another at Canterbury—"made a great building at Charing in Kent"—"almost the whole house of Forde. He builded at Alington Park."—*Leland.*

NAME.	COUNTRY	B.	D.	FL.	WORKS.
199 Gabriello d'Agnolo	Naples			1500	Church of S. Giuseppe; church of Santa Maria Egiziaca; palace for Ferdinando Orsini, duke of Gravina, at Naples.
200 Gian Francesco Normando	Florence			1500	Church of S. Severino; Palazzo Filomarini; Palazzo Cantalupo in the Posilipo, at Naples; several buildings in Spain.
201 Pietro Lombardo	Venice			1500	The tomb of Dante, the poet, in the church of St. Francis at Ravenna; church of S.S. Paolo, E. Giovanni, and monastery adjoining the church of Santa Maria Mater Domini; clock tower in the square of St. Mark; the German warehouse on the Rialto; the school della Misericordia; the cloister of Santa Giustina at Padua.
202 Martino Lombardo	Venice			1500	The school or confraternity of San Marco, and perhaps the church of S. Zaccaria at Venice.
203 John Cole	England			1501 to 1506	Builder of Louth spire or "*Broach.*"
204 Sir Reginald Bray	England		1503		The design of Henry VII.'s chapel, Westminster, and of other works at St. George's chapel, Windsor.
205 John Hylmer	England			1507	St. George's chapel, Windsor.
206 William Vertue	England			1507	A freemason, employed in executing the groined ceiling of the choir of St. George's chapel, Windsor.
207 Giuliano di San Gallo	Florence	1443	1517		The cloister of the Carmelites di Santa Maddelena de Pazzi at Florence; a cloister for the Fratri Eremitani di S. Agostino; la gran fabbrica del Poggio Imperiale, a fortress near the Porto a Prato, and other works at Florence; a magnificent palace at Poggio Cajana for Lorenzo di Me-

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					dici; repaired the cupola of the church della Madonna at Loreto; restored the roof and decorations of the ceiling of the church of Santa Maria Maggiore; restored the church dell' Anima; the Palazzo Rovere, near San Pietro in Vincula at Rome; the Palazzo Rovere at Savona; an unfinished palace at Milan; the fortress and gate of San Marco, of the Doric order; many palaces at Pisa; the fortifications at Ostia.
208 *Simone Cronaca, or Pollignolo	Florence	1454	1509		Façade of the Palazzo Strozzi at Florence; the church of S. Francis at S. Miniato, near Florence; convent of the Padri Serviti; the Sacristy of Santo Spirito and the council chamber at Florence.
209 *Aristotle Alberti	Bologna			16th cent.	A bridge in Hungary; several churches in Russia.
210 Leonardo da Vinci of Castello da Vinci,	near Florence	1443	1518		The aqueduct of the Adda at Milan; various machines, plans, and works on architecture.
211 *Fra. Giocondo	Verona	1435			Many bridges, especially that of Notre Dame at Paris; the public hall and Ponte della Pietra at Verona; the fortifications at Treviso; the cleansing of the Lagunes, and a design for the Ponte Rialto, at Venice; after the death of Bramante, he was engaged with Rafaelle and San Gallo in erecting St. Peter's at Rome.
12 Novello dá San Lucano	Naples			1500	The palace of prince Robert Sanseverino, duke of Salerno, at Naples; and the restoration of the church of San Domenico Maggiore, which was built by Lucano.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
213 Percy, John, abbot of Leicester	England		1520		Brick buildings at Leicester abbey.
214 Rafaelle d'Urbino	Urbino	1483	1520		Continued the erection of St. Peter's at Rome, after the death of Bramante, his master in architecture; subordinate in buildings of the Farnesian; church of Santa Maria in Navicella, repaired and altered; stables of Agostino, near the Palazzo Farnese; the Palazzo Caffarelli, now Stoppani; the gardens of the Vatican; the façade of the church of San Lorenzo, and of the Palazzo Uggoccioni, now Pandolfini, at Florence.
215 Bolton, W. prior of St. Bartholomew's	England			Hen. 8th 1509 to 1547	Supposed to have designed Henry VII.'s chapel, where he was master of the works.
216 John of Padua	Italy				"Devizer of buildings" to Henry VIII. of England.
217 Gibbes, W. last prior of Bath	England			Hen. 8th	Continued the building of Bath abbey church till the dissolution of monasteries.
218 Hector Asheley	England			reign of Hen. 8th	Surveyor of buildings, employed in the erection of Hunsdon house.
219 Andrea Contucci di Monte Sansovino	Italy	1460	1529		The beautiful chapel del Sagramento in the church di Santo Spirito; the palace della Canonica at Loretto; a cloister for the monks of S. Agostino, and a little chapel without the walls of Sansoverino; some buildings at Venice, and many in Portugal.
220 Bartolemeo Buono of Bergamo	Italy		1529		Church of S. Rocco; some parts of the campanile di San Marco, and the Procurazie Vecchie at Venice.
221 Guglielmo Bergamasco of Bergamo	Italy			1520	The Capella Emiliana of the Camaldulenses, at Murano, an island of the Lagunes; the Palazzo di Ca-

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					merlinghi, near the Ponte Rialto at Venice; Palace at Portogruato, in the Friuli; the gate di Santo Thommaso at Treviso; the gate called Il Portello at Padua.
222 *Maestro Filippo	Spain			1520	Restoration of the cathedral of Seville.
223 Giovanni di Ololzago, of Biscay	Spain			1520	Cathedral of Huesca in Arragon; he blended the modern Greek style with Gothic, in the manner called *Araba-tedescho.*
224 Pietro di Gamiel	Spain			1520	Convent of S. Eugracia at Saragossa; college of Alcala, in the Græco-Gothic style of architecture.
225 Giovanni Alonzo	Spain			1520	Sanctuary of Guadaloupe.
226 Fra Giovanni d'Escobedo	Spain			1520	The grand aqueduct of Segovia, by order of queen Isabella.
227 Giovanni Campero	Spain			1520	The church and convent of S. Francis, at Fordelaguna.
228 *Antonio San Gallo of Mugello,	near Florence		1546		The churches of the Madonna di Loretto near Trajan's column, of Santa Maria di Monserrato, of S. Giovanni de Fiorentini; the Palazzetto de' Conte Palma;. the Palazzi di Santo Buono for himself, now that of the Marchesi Sacchetti; Farnese, begun by Paul III., when a cardinal; the fortifications of Civita Vecchia, of Civita Castellana, of Parma, Ancona, and many other strong places in Italy; he altered the Mola of Adrian to its present form of the castle of S. Angelo; the triumphal arch in the square of S. Mark at Venice; a temple to our Lady at Monte Pulciano; he built the Capella Paolino del Vaticano, and assisted in the works of S. Peter's.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
229 *Baldassare Peruzzi	Volterra	1481	1536		Plan and model of the cathedral or duomo at Carpi; two designs for the façade of San Petronio, and the gate of San Michele in Bosco at Bologna; fortifications at Sienna; the little palace built for Agostino Chigi, now called the Farnesina in the Langara; the Palazzo Massimi, near the church of San Pantaleo; the Villa di Papa Giulio III.; the cortile of the palace de Duchi Altemps; the casino at the Palazzo Chigi; the tomb of pope Hadrian IV. in the church dell' Anima; the Palazzo Spinosa, now the hospital degli Eretici convertiti at Rome; he assisted in the erection of St. Peter's, and was buried by the side of Rafaelle, in the Pantheon. His style was distinguished for taste.
230 Marco di Pino	Sienna			1530	Modernized the church della Trinita di Palazzo, and built the church and convent of Giesu Vecchio at Naples.
231 Andrea Brioso	Padua			1530	The Loggia, and council-house in the Piazza di Signori at Padua, finished in 1526.
232 Ferdinando Manlio	Naples			1530	Church and hospital della Nunziata; the Strada di Porta Nolana, and di Monte Olivetto, with other streets and palaces at Naples; a bridge at Capua.
233 Giovanni Merliano da Nola	Italy			1530	The Strada di Toledo; the church of S. Giorgio de' Genovesi; the church of S. Giacomo degli Spagnoli; plan of the palace del Principe di San Severo, and the palace of the ducca della Torre; the Castel Capuano altered to a court of law; a fountain at the extremity

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					of the Mole, and some triumphal arches for the entrance of Charles V., on his return from Tunis, at Naples.
234 Giovanni Gil de Hontanon	Spain			1530	Plan of the cathedral of Salamanca.
235 Baccio d'Agnolo	Florence	1460	1543		The beautiful bell tower or campanile of San Spirito; the lantern above the cupola of Santa Maria del Fiore, the great altar and choir of which was built by his son Giuliano; the palace for Giovanni Bartolini in the Piazza di Santa Trinita; the Palazzo Salvieto at Rome.
236 Giovanni Maria Falconetto	Verona	1458	1534		The church della Madonna della Grazie, for the Dominicans at Padua; a palace in the Castel d'Usopo in the Friuli; the palace for Luigi Cornaro, near the Santo; the Doric gate to the Palazzo Capitano; a music hall, which was much admired by Serlio, who denominated it "La Rotondo di Padoua;" the gates of S. S. Giovanni and Savonarola.
237 Rodrigo Gil de Hontanon	Spain			1540	Superintended the erection of the cathedral of Salamanca; built the cathedral of Segovia.
238 Pietro de Uria	Spain			1540	Bridge of Almaraz, over the Tagus.
239 Alonzo de Cobarrubias	Spain			1540	Façade of the Alcaziar at Toledo; convent and church of S. Michael at Valenza; repaired the church of Toledo, which was erected in 587, during the reign of king Reccaredo.
240 Diego Siloe	Toledo			1540	Cathedral and Alcaziar at Granada; church and convent of S. Gerome in the same city.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
241 *Girolamo Genga	Urbino	1476	1558		A palace of the duke of Urbino, sul monte dell' Imperiale; the court of the palace restored; the church of San Giovanni Battista, at Pesaro; façade of the cathedral and the bishop's palace at Mantua; the convent de' Zoccolanti at Monte Baroccio. His son, Bartolemeo, was also an artist of considerable repute, and there are several of his works at Mondavio, Pesau, and other parts of Italy.
242 Michelo San heli	Verona	1484	1559		Cathedral of Monte Fiascone; church of S. Dominichino at Orvietto; numerous fortresses in the Venetian territory, in Corfu, Lombardy, and the Ecclesiastical state, as at Legnani, Orri Nuovi, Castello; the palaces di Canossa della Gran Guardia on the Bra; Pelligrini de' Versi; the prefecturate and the façade of the palazzo Bevelaqua at Verona; the chapel Guareschi in the church of S. Bernardino; design for the campanile of the duomo; the churches of Santa Maria in Organo de Monaci, di Monti Olivetti, di San Giorgio, and della Madonna di Campagna, in the same city; the gates Nuova, del Pallio, di S. Zenone, del Palazzo Pretorio, and del Palazzo Prefettizio, at Verona; the fortifications of the same city, the first instance of the introduction of triangular bastions; the first bastion, that of della Madellina, was erected in 1527.
243 *Philibert de Lorme	France		1557		Commenced the Tuilleries; built the chateaus of Anet and Neudon.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
244 *G. Allesi	Italy	1500	1572		The Escurial in Spain; he was much employed at Genoa.
245 Sante Lombardio	Venice	1504	1560		The Palazzo Vendramini; the staircase and façade of the school of S. Rocco; the palaces Trevisani and Gradenigo, at Venice.
246 *Giacomo Barozzi da Vignola	Vignola	1507	1573		The magnificent palace at Caprarole, for cardinal Farnese.
247 Giulio Pippi; or Giulio Romano	Rome	1492	1546		The villa Madama; the Palazzo Lante, at San Pietro; church della Modona del Orto; Palazzo Ciccia porci alla Strada di Banchi; Palazzo Cenci sulla Piazza S. Eustachio, near the Palazzo Lante, and other buildings in Rome; the Palazzo del T, at Mantua; the palace at Marmiruolo, five miles from Mantua; the modernising and enlarging the ducal palaces, the duomo, and many other buildings in the same city; the façade of S. Petronio at Bologna; and some works at Vicenza. His style was cheerful and pleasing.
248 Michel Angiolo di Buonarotti	Florence	1474	1563		Library of the Medici, generally called the Laurentian library, at Florence; model for the façade of the church of San Lorenzo; the second sacristy of Lorenzo, commonly called the Capelle del Depositi; the church San Giovanni, which he did not finish; fortifications at Florence, and at Monte San Miniato; monument of Julius II. in the church of S. Pietro in Vinculis, at Rome; plan of the Campidoglio; palace of the Conservatori; the building in the centre, and the flight of steps in the Campidoglio or Capitol, at Rome; con-

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					tinuation of the palace Farnese, and several gates at Rome, particularly the Porta Nomentana, or Pia; the steeple of S. Michaele, at Ostia; the Carthusian church of Santa Maria degli Angeli; the gate to the vineyard del Patriarca Grimani; the tower of S. Lorenzo, at Ardea; the church of Santa Maria, in the Certosa, at Rome; many plans of palaces, churches, and chapels. He was employed on St. Peter's, after the death of San Gallo.
249 Mascall, or Marshall, Eustace,	England		1567		Clerk of the works to cardinal Wolsey, at the building of Christchurch college, Oxford, and chief clerk of accounts, for all the buildings of Henry VIII., within twenty miles of London.
250 Damiano Forment, of Valenza	Spain			1550	Façade of the church of S. Eugracia at Saragossa.
251 Martino de Gainza	Spain			1550	The chapel royal at Seville.
252 Alonzo Berruguete, of Parades, near Valladolid	Spain			1550	Plan of the former royal palace at Madrid; gate of S. Martino at Toledo; palace of Alcala in that city; he also assisted at the erection of the cathedral of Cuenza.
253 Pietro de Valdevira	Spain			1550	The beautiful chapel of S. Salvador at Ubeda; a palace in the same place; the hospital and chapel of S. Iago at Baeza.
254 Pietro Ezguerra, of Ojebar, near Perayas	Spain			1550	Cathedral of Plasencia; church of S. Matteo de Caceres; church of Malpartida.
255 Ferdinando Ruiz, of Cordova	Spain			1550	Heightened the great steeple of the cathedral of Seville, called the Torre della Giralda

NAME.	COUNTRY	B.	D.	FL.	WORKS.
256 Machuca	Spain			1550	Royal palace of Grenada.
257 Antonio Fiorentino	Florence		1570		Church of Santa Caterina a Formello at Naples; the cupola of this church is said to have been the first that was raised of any considerable magnitude in that city.
258 Jacopo Tatti, surnamed Sansovino	Florence	1479	1570		Church of S. Marcello begun, and that of S. Giovanni de' Fiorentini built; the Loggia on the via Flaminia, just out of the Porto del Popolo, for Marco Coscia; the Palazzo Gaddi, now del Nicolini, at Rome; church of S. Francesco della Vigna, which was finished by Palladio; the Palazzo Cornari, sul canal Grande at San Maurizio; the mint and other public buildings at Venice; church of San Fantino; church of San Geminiano, &c. His style was the Lombard.
259 Theodore Havens	England			1558	Caius college, Cambridge; a fair specimen of the architecture of the day, pedantic, eccentric, and affected.
260 Domenico Testocopoli	Greece			1560	College of the Donna Maria d' Arragona at Madrid; church and convent of the Dominican nuns, and also the Ayuntamiento at Toledo; church and convent of the Bernardine nuns at Silos. His style was heavy and gloomy.
261 Garzia d'Emere	Spain			1560	Parochial church of Valeria, near Cuenza.
262 Bartolemo di Bustamente	Spain			1560	Hospital of S. John the Baptist, near Toledo.
263 Giovan Batista di Toledo	Spain			1560	Designs for the Escurial; he assisted in planning the street of Toledo at Naples, the church of S. Iago, belonging to the Spaniards; a palace at Posilipo in the same city.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
264 John Thynne	England				Built Somerset house in 1567.
265 Giovanni d'Herrera, of Movellar	Austria			1570	He continued the Escurial after the death of his master, Giovan Battista; plan of the church of S Jago, near Cuenza; bridge of Segovia at Madrid; palace of Aranjuez.
266 Pierre de Lescott	France	1510	1578		The Fontaine des Saintes Innocens, in the rue Saint-Denys at Paris.
267 *Sebastiano Serlio	Bologna		1578		The palace of Grimani, at Venice; employed by Francis I. of France, at Fontainbleau.
268 *Bartolemeo Ammanati	Italy	1511	1592		The Palazzo Pitti; the beautiful bridge of Santissima Trinita; Rucellai palace at Rome; Jesuit's college at Rome.
269 *Nicholas Abate	Modena	1512			The old Chateau of Meudon; tomb of Francis I. at S. Denys; decorated the apartments of the palace of Fontainbleau.
270 *Andrea Palladio, of Vicenza	Italy	1518	1580		Palace Foscari; Olympic theatre at Vicenza.
271 Dominico Fontana	Milan	1543	1670		Chapel of the Manger in the church of S. Maggiore; library of the Vatican.
272 John Shute	England				A painter and architect, who flourished during the reign of queen Elizabeth, from 1558 to 1608.
273 Robert Adams	England				Superintendent of royal buildings to queen Elizabeth.
274 Louis de Foix	France			end of 16th cent.	Monastery of the Escurial in Spain; the new canal of the Adour; the "Tour de Cordouan," at the mouth of the Garonne.
275 *Jaques Androuet du Cerceau	France			end of 16th cent.	Pont Neuf at Paris; the hotels de Sully, de Mayenne, and that of the Fermes Général; designed the fine gallery, built by Henry IV at the Tuilleries.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
276 * Vincenzo Scamozzi	Vicenza	1552	1616		The supposed inventor of the angular Ionic capital; he made some additions to the library of S. Mark, finished the Olympic theatre at Vicenza, and built a theatre at Sabioneta.
277 *Carlo Maderno	Lombardy	1556	1629		Altered Michel Angiola's design for St. Peter's at Rome, from a Greek to a Latin cross; began the palace of Urban VIII.
278 John Warren	England			1608	Architect of St. Mary's church tower, Cambridge.
279 Sir H. Wotton	England	1568	1639		Author of "the Elements of Architecture," published, London, 1624.
280 Inigo Jones	England	1572	1651		The banqueting house; the chapel of Lincoln's Inn; Surgeon's hall; the arcade of Covent Garden.
281 * Giovanni Battista Alisti	Ferrara		1630		Fortress at Ferrara; many palaces, theatres, and other public buildings at Mantua, Parma, Modena, and Venice.
282 Pierre le Muet	France	1591	1669		Plan for the Grand Hôtel of Zuynes; the hôtel l'Aigle and Beauvilliers.
283 *Francesco Borromini	Italy	1599			Author of "numerous absurdities," at Rome and Florence.
284 Alessandro Algardi	Bologna	1602	1654		Chiefly employed at Rome.
285 *Lorenzo Bernini	Naples	1598	1680		The celebrated piazza, colonnade, and staircase, at St. Peter's; grand fountain of the Piazza Navona.
286 * François Mansart	France	1598	1666		Abbey of Val de Grace; Chateau des Masons; portal of the Minims in the Place Royale.
287 *Alonzo Cano	Spain	1600	1676		The "Michael Angelo of Spain."
288 *Claude Perrault	France	1613	1688		Façade of the Louvre; chapel of Sceaux; chapel of Notre Dame, in the church of the Petits Péres.
289 *François Blondel	France	1617	1686		Bridge over the Charente, at Saintes; gate of S. Denis, at Paris, repair and deco-

NAME.	COUNTRY	B.	D.	FL.	WORKS.
					rations of the gates of S. Antoine and S. Bernard.
290 *Antoine le Pautre	France	1614	1691		Wings of St. Cloud; church of the nunnery of Port Royal; hotels of Gevres and Beauvais.
291 Jaques le Mercier	France			Louis XIII and XIV. 1610 to 1715	La Sorbonne; le Palais Royal; S. Roch; le Val de Grace; were erected by him after the designs of Mansard.
292 Chrismas, Gerard	England			17th cent.	Designed Aldersgate, London, was an "architect and sculptor."
293 John Evelyn	England	1620	1705 1706		
294 * Sir Christopher Wren	England	1632	1723		St. Paul's; city of London, after the fire; Hampton Court; Greenwich Hospital, &c.
295 Robert Hooke	England	1635	1702		Bethlem Hospital; Ashe's Almshouses; British Museum. He was the associate of Wren. He gave a plan for rebuilding London, after the fire.
296 John Benson	England				The successor to Wren.
297 Carlo Fontana	Italy	1634	1714		One of the last architects of St. Peter's.
298 Julis Hardouin Mansart	France	1639	1708		The Dôme des Invalids; la Galerie du Palais Royal; the Place de Louis le Grand; that des Victoires; &c. He was the nephew of Francis Mansart.
299 Francesco Fontana	Rome		1708		
300 Rev. H. Aldrich	England	1647	1710		Three sides of the quadrangle of Christ's church, called Peckwater's square, chapel of Trinity college, and church of All Saints, at Oxford.
301 Sir John Vanbrugh	England		1725 1726		Blenheim house; Castle Howard, Yorkshire; Eastberry, Dorset; King's Weston, near Bristol; St. John's church, Westminster; the Opera-house.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
302 Robert de la Cotte	France	1657	1735		He continued the dôme des Invalides; finished the chapel of Versailles; and raised the new buildings of S. Denys.
303 Nicholas Hawksmoor, pupil to Wren	England	1666	1736		Designed the church of St. George, Bloomsbury, and St. Anne, Limehouse.
304 Alexander Jean Baptiste le Blond	France	1679	1719		L'Hôtel de Vendôme in the rue d'Enfer, at Paris. He was employed in Russia by Peter the Great.
305 Gilles Maria Oppenord	France		1730		
306 *Germain Boffrand, of Nantes	France	1667	1755		Much employed in Paris and Germany.
307 *Jean de Bott	France	1674	1745		Fortifications of Weissel.
308 James Gibbs	Scotland	1674	1754		Radcliffe library, Oxford; the new church in the Strand; St. Martin's in the Fields; King's college, Royal library, and Senate house, Cambridge.
309 William Kent	England	1685	1748		Temple of Venus at Stowe; Earl of Leicester's house at Holkham, Norfolk; staircase at Lady Isabella Finche's in Berkeley square.
310 *Edmund Bouchardon	France	1698	1762		Several fine buildings at Paris.
311 *François Cuviller	France	1698	1760		Sometime employed by the elector of Munich.
312 Jean Nicholas Servandoni	Florence	1695	1766		Part of the church of S. Sulpice, at Paris; many theatres, and decorations for theatres, at different places.
313 *François Blondel, of Rouen	France	1705	1774		Royal abbey of St. Louis; a street and square leading opposite to the cathedral, at Rouen; many other works both there, and at Strasburg.
314 Earl of Burlington	England			1730	Chiswick House; Burlington House, Piccadilly.
315 John Brettingham	England				Holkham Hall, in Norfolk, finished in 1764.

NAME.	COUNTRY	B.	D.	FL.	WORKS.
316 *John Rodolphus Perronet	France	1708	1794		Director of the bridges and roads of France.
317 *Jacques Germain Soufflot	France	1714	1780		Hospital at Lyons; exchange, concert-room, and theatre, in the same city; portal, nave, and towers of the church of St. Geneviève.
318 *Nicholas Antoine Boulanger	France	1722	1759		Bridges, causeways, and various public works in Champagne, Burgundy, and Lorraine.
319 *Sir William Chambers	England		1796		Somerset House.
320 *Robert Adam	England	1728			Architect to the king; author of a work on the Ruins of Spalatro; his principal works are the register-office at Edinburgh; the infirmary at Glasgow; the Edinburgh university; Luton mansion-house; Adelphi terrace.
321 *James Adam	England				Brother and colleague of Robert Adam.
322 *James Wyatt	England	1743	1813		Pantheon in Oxford-street, London; palace at Kew; Fonthill abbey, &c.; repaired Henry VII.'s chapel, the House of Lords, &c.

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No. II.

A MANUAL OF ARCHITECTURAL BIBLIOGRAPHY,

ARRANGED IN CLASSES.

Class I. Grecian Architecture.
II. Roman Architecture.
III. Miscellaneous Works on ancient Architecture.
IV. Old English and Gothic Architecture.
V. Modern English Architecture.
VI. Foreign Architecture, (modern.)
Class VII. Rural Architecture.
VIII. Ornaments.
IX. Sepulchral Monuments.
X. Theatres, &c.
XI. Bridges, &c.
XII. Elementary and Practical Works.
XIII. Miscellaneous.

CLASS I.—GRECIAN ARCHITECTURE.

1. Aberdeen, Earl of.
An Inquiry into the Principles of Beauty in Grecian Architecture, 8vo. 1822.
2. Aikin, Edmund.
An Essay on the Doric order, imperial folio. 1810.
3. Cockerell, R. C., A.R.A. F.S.A.
Temple of Jupiter Olympius at Agrigentum, commonly called the Temple of the Giants, royal folio, 10 fine plates, and 3 vignettes, by Moses, Edwards, Carter, &c. 1830.
Grand Restoration of Athens, its Temples, Sculpture, &c., engraved by J. Coney, very large folio size. 1829.
"The complete Elucidation of the Temple of Ægina," is advertised to be in the press.
4. Delagardette.
Les Ruines de Pæstum, ou Posidonia, ancienne Ville de la Grand Grèce, Levées, Mesurées, et Dessinées sur les lieux. Royal folio. Paris. 1799.
5. Gartner, F.
Architectural Monuments of Greece and Sicily, folio. Munster. 1819. The description is in German, the plates being lithographed.
6. Harris and Angell.
Sculptured Metopes at Selinus, large 4to., plates. 1826.

7. Hittorfs, J.
Architecture Antique de la Sicile. Paris, 1825-30. It is published in six livraisons, and has numerous well-executed plates. It is uniform with his work on the Modern Architecture of Sicily. See Class VI.

8. Kinnard, W.
Antiquities at Athens and Delos illustrated, imperial folio. 1830.

9. Le Roy, M.
Les Ruines des plus Beaux Monuments de la Grece, considerées du côte de l'Histoire et du côte de l'Architecture, 2 vols. folio. Paris, 1770. 60 fine engravings.
This work is accused by Stuart of great incorrectness.

10. Major, T.
Ruines de Pæstum, large folio, 1768, with 24 fine plates.

11. Riou, S.
Grecian Orders of Architecture, delineated and explained from the Architectural Antiquities of Athens, folio, London, 1768, with 28 plates and vignettes, by Grignion.

12. Stanhope, J. S.
Olympia, or Topography illustrative of the ancient State of the Plain of Olympia, and of the Ruins of the City of Elis, imperial folio, 1824. Very fine plates, by George Cooke, from the drawings of Dewint and Allason.

13. Stuart, James, F.R.S. F.S.A. and Nicholas Revett.
The Antiquities of Athens, 4 volumes, large folio, 1762, &c.
Antiquities of Athens, a second edition, with a very considerable Augmentation of Notes of Subjects further elucidated and brought to light by scientific travellers since the times of Stuart and Revett, edited by W. Kinnard, Architect, with an additional and entirely new Volume (as Supplement) of Architecture and Antiquities in Greece, Sicily, &c., the result of recent Travels and Investigations, by C. R. Cockerell, A.R.A. F.S.A., W. Kinnard, T. L. Donaldson, W. Jenkins, and W. Railton, architects, 4 volumes, royal folio, about 200 plates, 1825-30.

The three Volumes of this new edition of Stuart and Revett contain, besides the text, notes and further elucidations of Grecian Architecture, extracted from the editor's own researches; also, the discoveries of those eminent Architects and Antiquaries who have kindly favoured this edition with their useful details and corrections, made in recent travels. The fourth is supplementary to the original researches of Stuart and Revett, and augments the knowledge of Grecian architectural composition, by the accession of the details of three Temples, never hitherto adequately published: the Temple of Jupiter Olympius at Agrigentum, renowned for its colossi and gigantic dimensions, by Mr. C. R. Cockerell; that of Phigalia, important from the pure age and style of art in which it was executed, by Mr. T. L. Donaldson; and that of Corfu, by Mr. W. Railton, peculiar in the details, and interesting, as recently discovered in a British possession. With these subjects are introduced the details and restoration of the Treasury of Atreus. The volume contains also many delineations of detached examples of Grecian antiquity, illustrated by remarks on the character of Athenian edifices and Grecian decoration; among which are a disquisition on the origin of Grecian ornament, by Mr. W. Kinnard; a parallel of the Entasis of Athenian columns, by Mr. W. Jenkins; and an Essay on the arrangement of the Greek theatre, illustrated by original plans of three Grecian edifices of that description. Corrected details of Antiquities at Delos, and various fragments of pure Grecian Ornamental Architecture, are also inserted.

14. WILKINS, WM., M.A. R.A. F.S.A.

The Antiquities of Magna Græcia, imperial folio. Eighty-seven fine engravings of views, and architectural plates of Grecian temples, with their details. Cambridge, 1807.

Athenienisia, or Remarks on the Topography and Buildings of Athens, royal octavo. 1816.

15. ——— ———

The unedited Antiquities of Attica, comprising the Architectural Remains of Eleusis, Rhamnus, Sunium, and Thoricus. By the Society of Dilettanti, and edited by Wilkins, Gandy Deering, and Bedford, imperial folio, 79 fine plates. 1817.

The Antiquities of Ionia, by Chandler, Revett, and Parrs, 2 volumes, imperial folio, 1817, with fine plates. A new edition of the first volume was edited by Wilkins, Gandy Deering, &c.

Antichita Siciliane Spiegate, opera del Padre D. Guis, M. Pancrazi, 2 tom. folio. Napoli, 1751.

Voyage Pittoresque en Sicile, dédié à son Altesse Royale Madame la Duchesse de Berry; most sumptuous profusion of very beautiful plates, engraved from the drawings of the best artists of Europe. Paris.

CLASS II.—ROMAN ARCHITECTURE.

16. ADAM, ROBERT, F.R.S.

Ruins of the Palace of the Emperor Dioclesian at Spalatro, in Dalmatia, large folio, with 61 plates, finely engraved by Bartolozzi and others, 1764.

Architectural Remains in Rome, Pola, and Naples, from drawings by Clerisseau, under the direction of Robert Adam, Esq. F.R.S.

17. ALLASON, T.

Picturesque Views of the Antiquities of Pola, in Istria, large folio, 1817, with 14 fine plates.

18. BARBAULT.

Vues des plus beaux Restes des Antiquités Romaines, large folio, Rome, 1775. 120 plates.

19. BELLORI, J. P.

Veteres Arcus Augustorum Triumphis insignes ex Reliquiis quæ Romæ adhuc supersunt, per J. J. de Rubeis, large folio, Roma, 1690. 52 fine plates.

20. BLOUET, G. ABEL.

Restauration des Thermes d'Antonin Caracalla à Rome, large folio, very fine plates. Paris, 1828.

21. BORIONI, A.

Collectanea Antiquitatum Romanarum quas centum tabulis Æneis incisas, et A. R. Venuti notis illustravit, folio, with 103 fine plates by Rossi.

22. CARISTIE, AUG.

Plan et Coupe d'un Partie du Forum Romaine, et des Monumens sur la Voie Sacrée, Atlas folio. Paris, 1821

23. Cameron, C.
Baths of the Romans explained and illustrated, with the Illustrations of Palladio, a large and thick folio, with 75 plates, 1772.

24. Castell, R.
Villas of the Ancients illustrated, plates, large folio, 1728.

25. Clerisseau, C.
Antiquités de la France, (Nismes,) le texte historique et descriptif, par J. G. Le Grand, imperial folio. Paris, 1804. 63 fine plates. See also *Adams, Robert*.

26. Desgodetz, M.
Les Edifices Antiques de Rome, 140 plates, folio. Paris, 1779.
Ancient Buildings of Rome, translated by George Marshall, 2 vols. large folio, 1771.
The French edition of 1682 contains 300 plates.

27. Gell, Sir W., and J. P. Gandy Deering.
Pompeiana, the Topography, Edifices, and Ornaments of Pompeii, 2 vols. imperial octavo, with fine plates, 1824.

28. Labacco.
Libro d'Antonio Labacco Appartenente a l'Architettura, nel qual si figurano alcune notabili Antiquita di Roma, folio, plates, Roma.

29. Mazois, F.
Ruines de Pompei dessinées et Mesurées, 31 livraisons, imperial folio, with beautiful plates. Paris, 1830.

30. Morghen, F.
Gabinetto di tutte le piu interessanti Vedute degli Antiché Monumenti esistenti in Pozzuolo, Cuma, e Baja, oblong folio, 41 plates. Napoli, 1803.
Veduta di Pesto, Napoli, Pozzuoli, Baja, Cuma, &c. oblong folio, with 40 plates.

31. Moreau, C.
Fragmens et Ornamens d'Architecture, dessinées à Rome d'après l'Antique, formant un supplément à l'Œuvre d'Architecture de Desgodetz, very large folio, with 36 well-engraved plates. Paris.

32. Nibby, Ant.
Del Foro Romano, della Via Sacra, dell' Anfiteatro Fluvio, e di Luoghi Adjacenti, octavo. Roma, 1819.

33. Averbeke.
Antiquities of Rome, Atlas folio, with fine plates.

34. Palladio, Andrea.
Il Tempio di Minervà in Assisi, confrontato colle Tavole da Giov. Antolini, fol. Milano.
Les Thermes des Romains, dessinées par André Palladio, par O. B. Scamozzi d'après l'Exemplaire du Lord Burlington, folio. Vicenza, 1785.

35. Piranesi, J. Baptist,
Works complete, published after his death by his son, Francis Piranesi, in 29 volumes imperial folio, containing nearly 2000 plates.

The contents of these volumes are as follows:

Vol. 1. Ruins of ancient edifices at Rome, with the explanation, aqueducts, baths, the forum, &c. &c.

Vol. 2. Funeral monuments, cippi, vases, &c.

Vol. 3. Ancient bas-reliefs, stuccoes, mosaics, inscriptions, &c.

Vol. 4. The bridges of Rome, the remains of the isle of Tibur, the ruins of the theatre, porticoes, &c.

Vol. 5. The monuments of the Scipios.

Vol. 6. Ancient temples, the temples of Vesta, of Honour and Virtue, statue of the goddess Vesta, altar to Bacchus, the pantheon, &c.

Vol. 7. The magnificence of the ancient Roman architecture, pedestals of the arches of Titus and Septimius Severus, portico of the capitol, &c.

Vol. 8. Grecian, Etruscan, and Roman architecture, arches of triumph, bridges, temples, amphitheatres, prisons, &c.

Vol. 9. Fetes and triumphs, from the foundation of Rome to Tiberius, temple of Castor and Hercules, and other antique monuments of the ancient city of Cora, &c.

Vol. 10. The Campus Martius, ruins of the theatre of Pompeii, portico of Octavius, reservoir of the Virgin Water, mausoleum of Augustus, palace of Aurelius, the Pantheon, the cave of the Archives of the Romans, baths and tombs of Adrian, apotheosis of Antoninus Pius, arch of Marcus Aurelius, baths of Sallust, &c.

Vol. 11. Antiquities of Albano, temple of Jupiter, sepulchres attributed to the Horaces, amphitheatre of Domitian, ancient baths, &c.

Vols. 12, 13. Candelabras, vases, lamps, &c.

Vol. 14. The Trajan and Antonine columns.

Vol. 15. Ruins of Pæstum.

Vols. 16, 17. Principal modern edifices of Rome.

Vol. 18. Ancient statues and busts.

Vol. 19. Theatre of Herculaneum.

Vol. 20. Egyptian, Grecian, Etruscan, and Roman chimney pieces, ornaments, &c.

Vols. 21—26. Paintings after Guerchino, Rafaello, Michael Angelo, &c.

Vol. 27. Pompeii, its tombs, utensils, ornaments, &c.

Vol. 28. Antiquities of Pompeii, its houses, &c.

Vol. 29. Antiquities of Pompeii and Herculaneum.

Antichita Romane de Tieme della Republica e de primi Imperatori, small oblong folio, with 28 plates.

Della Magnificenza ed Architecture de Romane, imperial folio, Roma, 1761.

36. ROSSINI,

Veduta di Roma, 101 very large folio views of the most remarkable antiquities and buildings in Rome and its neighbourhood, 2 vols. Roma, 1823-4.

37. RUBEIS, DOMINICI DE.

Romanæ Magnitudinis Monumenta, oblong folio, with 138 plates, Romæ, 1699.

38. RUBEIS, J. DE.

Insignium Romæ templorum prospectus exteriores interioresque, a celeb. architect. inventi, nunc tandem suis cum plantis ac mensuris, folio, Romæ, 1684. 71 plates.

39. SEYNES, ALP. DE.

Monumens Romains de Nismes, folio, Paris, 1818. 16 plates.

40. TAYLOR, G. L. and EDWARD CRESY.

Architectural Antiquities of Rome, 2 vols. imperial folio, 1821-2.

41. VALADIER'S, G.

Raccolta delle più insigni Fabbriche di Roma Antica e sue Adjacenze: I. Tempio di Antonino e Faustina, 9 plates. II. Tempio detto della Sibilla in Tivoli, 10 plates. III. Tempio detto di Vesta in Roma, 5 plates. IV. Tempio detto di Giove Statore, 8 plates. V. Tempio di Giove Tonante, 10 plates; Colonna Onoraria di Foca Imperature eretta in Roma da Smaragdo Patrizio ed Esarco d'Italia, 3 plates. VI. Teatro di Marcello, 7 plates. VII. Tempio detto di Marte Ultore, 11 plates; large imperial folio, containing, together, 63 very fine plates by Vincenzo Feoli, of Rome, Roma, 1810-26.

Arco di Tito, 4to., Roma, 1822. 8 plates.

42. **Vasi, Guiseppe.**
Magnificenze di Roma Antica e Moderna, comprised in a collection of 200 topographical views; with historical descriptions in Italian. 3 vols. oblong 4to., 1747.

43. **Wood, R.**
Ruins of Balbec, large folio, 1757.
Ruins of Palmyra; large folio, 1753.

44. ——— ———
Antichita d'Ercolano, esposte con qualche spiegazioni; with an immense number of engravings from the busts, bas-reliefs, statues, urns, paintings, buildings, &c. &c. discovered in the subterraneous ruins of that celebrated city, 9 vols. folio, Napoli, 1765-92.
Antichita di Pozzuoli, large folio, with near a hundred fine plates, the text engraved in Italian and Latin.
Descrizione Antiquario-Architettemia con rami dell'Arco di Augusto, Ponte di Tiberio, e Tempio Malatestiano di Rimino, folio, Rimino, 1813. 17 plates.
Dissertazione sull' Architettura del Tempio di Roma, 4to., Roma, 1820.
Ruins of Rome and its vicinity, (a select collection of) executed from drawings made upon the spot, in the year 1791, with descriptions in French and English, 4to. 1797.

CLASS III.—MISCELLANEOUS WORKS ON ANCIENT ARCHITECTURE; EGYPTIAN, INDIAN, &c.

45. **Belgrado.**
Architettura Egiziana, Dissertaziona d'un Corrispondente dell' Academia della Scienzi di Parigi, &c. 4to., Parma, 1786.

46. **Cassas.**
Voyage Pittoresque de la Syrie, de la Phenicie, de la Palestine et de la Basse Egypte, 2 vols. large folio. This work contains a profusion of fine plates of the temples and other buildings of these countries, with many plates of architectural details.

47. **Coste, P.**
Architecture Arabe, ou Monumens du Kaire dessinés et mesurés pendant 1820, 21, 22, Paris, 1824.

48. **Fox's, W.**
Grecian, Roman, and Gothic Architecture, 8vo., 1827.

49. **Freart, R., of Cambray.**
Paralléle de l'Architecture Antique et de la Moderne, folio, Paris.
Parallel of the ancient and modern Architecture, translated by J. Evelyn, folio, 1733.

50. **Gau, F. C.**
Antiquités de la Nubie, ou Monumens inédits des bords du Nil, situés entre la premiere et la seconde Cataracte, 11 livraisons; elephant folio, Paris, 1824-5.

51. **Langles, L.**
Monumens, Anciens et Modernes, de l'Hindoustan, 2 vols. folio, Paris, 1818.

APPENDIX II.

52. Le Brun, L.

Théorie de l'Architecture Grecques et Romaine, déduile de l'Analise des Monumens Antiques, &c. Avec des planches et un discours préliminaire, par Fr. Et. Joubert, folio, Paris, 1807, with 26 plates.

53. Montfaucon, Bernard de.

L'Antiquité expliqée et representée en figures, 5 vols. folio, Supplement, 5 vols. folio. In all 964 plates, Paris, 1729-33.

The following is a list of that part of the contents which relates to Architecture.

Tom. 1, to 3. Statues, bas-reliefs, gems, &c.

Tom. 4. pt. 1. Triumphal arches, columns of Trajan and Antonine.

Tom. 4. pt. 2. Roads, bridges, aqueducts, ships, &c.

Tom. 5. pt. 1. Hypogæa, columbaria, sepulchres, mosaics, tombs, sepulchral urns, mausoleums.

Tom. 5. pt. 2. Egyptian pyramids, tombs of the Gauls and Germans, and of other ancient nations.

Supplement, tom. 1. Statues, &c.

Tom. 2. Temples, mosaics, altars, temples of the Egyptians, temple of Montmorillon, column of Cussi, temple at Corseul, &c.

Tom. 3. Statues, vases, coins, &c.—Labyrinths, columns of Pompey and Severus, gateways of ancient cities, baths, fountains, theatres.

Tom. 4. Statues, busts, &c.—Triumphal arches, bridges, aqueducts, milliary columns, ships, seaports, light-houses, octagonal towers, tesselated pavements.

Tom. 5. Tombs of the Romans, Etruscans, Gauls, &c., Druidical circles, &c.

Montfaucon's Antiquities and Supplement; translated by Humphrey, with the Antiquities of Italy, being his Travels from Paris through Italy in the years 1698 and 1699, 9 vols. folio, 1721, &c.

54. Morris, R.

Essay in defence of ancient Architecture, 4to., 1728.

55. Murphy, J.

Arabian Antiquities of Spain, elephant folio, 1816, with 100 very fine plates.

56. Normand, C.

Nouveau Parallèle des Ordres d'Architecture des Grecs, des Romains, et des Auteurs modernes, folio, Paris, 1819.

New Parallel of the Order of Architecture, according to the Greeks and Romans and modern Architects, with the original plates, drawn and engraved by C. Normand, arch. The text translated, and 2 additional plates, by Mr. Pugin, folio, 62 plates, 1829.

57. Quincy, Quatremere de.

L'Architecture Egyptienne considerée, 4to., Paris, 1803. 18 plates.

58. Smith, J.

Specimens of Antient Carpentry, 4to. 40 plates.

59. Vitruvius.

Vitruvii de Architectura Opera, cum Comment. D. Barbari, folio, wood-cuts, Venet. 1567.

Vitruvii de Architectura Opera, cum Notis Variorum, et Lexicon, &c. a J. de Laet, folio, Amst. L. Elzevir. 1649.

Vitruvii de Architectura Opera ad opt. edit collati stud. Soc. Bipont. 8vo. Argent, 1807.

Formæ ad explicandos Vitruvii decem libras de Architectura, curâ A. Rode, folio, Berolini, 1801.

I dieci Libri dell' Architectura di Vitruvio, trad. et commentati da M. Barbaro, folio, wood-cuts, Venice, 1556.

L'Architettura generale di Vitruvio, 12mo. plates, Venice, 1747.

L'Architettura di Vitruvio Trad. e Conventata dal Marchese B. Galiani, folio, plates, Napoli, 1790.

Les dix Livres d'Architecture de Vitruve, Trad. par Perrault, folio, Paris, 1673, 1684.

Vitruvius's Architecture, translated by W. Newton, 2 vols. folio, plates, 1791.

Vitruvius' Civil Architecture, translated by W. Wilkins, M.A. R.A. F.S.A., containing also, as an Introduction to the work, the Earl of Aberdeen's Inquiry into the Beauty of Grecian Architecture, 2 vols. imperial 4to., 41 fine plates by Lowry, 1812-17.

The Architecture of Vitruvius, in ten books, translated by Joseph Gwilt, F.S.A. Illustrated with ten plates, explanatory of those parts of the text more especially relating to Civil Architecture, and ten vignettes, one at the head of each book, imperial 8vo. 1825, uniform with Gwilt's edition of Chambers.

60. WINCKELMANN.

Remarks sur l'Architecture des Anciens, 8vo. Paris, 1788.

61. ——— ———

Paralléle de l'Architecture Antique et de la Moderne, folio, several plates, Paris, 1702.

Rudiments of Ancient Architecture, with a Dictionary of Terms, 8vo. plates, 1804.

CLASS IV.—OLD ENGLISH AND GOTHIC ARCHITECTURE.

62. ASTLE, T.

On Stone Pillars, Crosses, and Crucifixes, 4to., plates, 1803.

63. ATKINSON, THOMAS, of Stamford Street.

Gothic Ornaments, selected from the different Cathedral Churches in England, imperial 4to., 48 plates, 1828-9.

64. BOISSEREE, SULPICE.

Histoire et Description de la Cathedrale de Cologne, accompagnée de Recherches sur l'Architecture des Anciennes Cathedrales; imperial folio, with a very large atlas folio volume of plates, consisting of a View of Cologne, the Rhine, and the Cathedral; perspective Views of the Cathedral; Plan of the Cathedral; Geometrical Elevation; Transverse Section; Capitals, Columns, and other Details; Windows, with their stained glass, coloured; Details of Buttresses and Parts; eight plates in all, drawn and engraved beautifully to a very large scale. Stuttgard, 1827.

65. BENTHAM, JEREMY.

History and Antiquities of the Church of Ely, large 4to., 1771.

66. BOUILLART, J.

Histoire de l'Abbay Royale de Saint Germain des Pres, folio, with very fine plates. Paris, 1724.

67. BRIDGIN, R.

Sefton Church, with part of the Interior Decorations, imperial 4to., 31 plates, 1822.

68. Britton, John, F.S.A., &c.

Architectural Antiquities of Great Britain, 4 volumes, 278 fine plates, 1805.

Chronological and Historical Illustrations of ancient Ecclesiastical Architecture of Great Britain, designed as a fifth volume of the preceding, thick 4to, with 86 plates, 1827.

Cathedral Antiquities:—Salisbury, 31 fine plates, 4to.; Norwich, 25 plates; Winchester, 30 plates; York, 35 plates; Lichfield, 16 plates; Oxford, 11 plates; Canterbury, 26 plates; Wells, 22 plates; Peterborough, 16 plates; Gloucester, 22 plates; Bristol, 12 plates; Hereford, 16 plates; Bath, 10 plates; Exeter, 22 plates.

History and Illustration of Redcliffe Church, Bristol, 12 plates, royal octavo, 1813.

Union of Architecture, Sculpture, and Painting, exemplified in a series of 23 engravings and 6 wood-cuts; with descriptive Accounts of the House of John Soane, 4to. 1827.

Picturesque Antiquities of English Cities, 60 fine plates, 4to.

Picturesque Views of the English Cities, by Robson, 31 plates, 4to.

Illustrations of Fonthill Abbey, fine plates, 4to. 1823.

Dictionary of the Architecture and Archæology of the Middle Ages. royal 8vo. fine plates.

Architectural Illustrations of Roslyn Chapel, Scotland, 14 plates, imperial 4to. 1810.

69. Carter, J.

Ancient Architecture of England, 2 vols. folio, 106 plates, 1793.

70. Chapuy.

Vues Pittoresques de la Cathedrale de Paris, imperial 4to., 10 plates. Paris, 1823.

Cathedrales Françaises, large 4to., plates on India paper, Paris,1827.

71. Clarke, W. B.

The ancient Crosses of England Restored, by W. B. Clarke, Architect, in 6 Numbers, each containing 2 plates, large folio: plate 1, a Restored Outline, engraved by Turrell; plate 2, the Plans, Sections, and Details. The text consists of an Historical Account of each Building, and Critical Remarks on the Style of their Architecture and Beauty of the Design. No. I. contains the Drawings of Waltham Cross.

72. Cotman, J. S.

Etchings of ancient Monastic, Collegiate, Castellated, and Domestic Gothic Antiquities, large folio, 25 plates, 1811.

Specimens of the Architectural Antiquities of Norfolk, containing 60 finished etchings, representing exterior and interior views of the most celebrated remains of Antiquity in the County, large folio, 1818.

Antiquities of St. Mary's Chapel, at Stourbridge, near Cambridge, folio, 1819.

Architectural Antiquities of Normandy, represented and illustrated in a series of 100 etchings, 2 vols. folio, 1820-21.

73. Cottingham, L. N.

Plans, Elevations, Sections, and Details of King Henry the VII.th's Chapel at Westminster, (the Exterior,) atlas folio, 45 plates, 1822.

Views, Plans, Elevations, Sections, and Details of the Interior of King Henry the VII.th's Chapel at Westminster; fine elaborate plates, usefully detailed, and illustrative of the whole Interior of this magnificent Gothic structure. 1830.

Working Drawings for Gothic Ornaments, selected and composed from the best Examples; consisting of Capitals, Bases, Cornices, Friezes, Pendants, Crockets, Corbals, Spandrils, Roses, Battlements, Doors, Windows, various specimens of Mouldings, and a design for a Gothic Mansion; atlas folio, 38 plates, with a Description. This work was purposely got up for the use of the architect, modeller, carver, ornamental painter, &c. &c. being on a large scale, with sections, showing the depths of the undercuttings, &c.

Plans, Elevations, Sections, and Details at large of Westminster Hall, atlas folio, 1822.

74. Cresy, Edward, and G. L. Taylor.

The Architecture of the Middle Ages at Pisa, illustrated by Plans, Sections, Elevations, Details, and Views of the Baptistery, Campanile or Leaning Tower, Cathedral, and Campo Santo; from Drawings and Measurements taken in the year 1817; accompanied by descriptive Accounts of their History and Construction; by Edward Cresy and G. L. Taylor, Architects and F.S.A. imperial quarto, fine plates, 1828-9.

These buildings exhibit the finest specimens of the Lombard style to be found in Italy, and are curious, as affording the earliest examples of the pointed or Gothic character in that country. The Leaning Tower has long been an object of attention to travellers. The Pointed Architecture within and without the Baptistery is assigned to a much later period than is usually given to it, as is proved by the discovery of the Monument of the Architect, and an inscription on the Building. The Cathedral and Campo Santo are well known as the most superb edifices of the middle ages in Italy.

75. Dallaway, Rev. J.

Observations on English Architecture, royal 8vo. 1806.

Notices of ancient Church Architecture in the 15th century, 4to. 1824.

76. Davy, H.

Architectural Antiquities of Suffolk, folio, 1823-4.

A Set of Etchings illustrative of Beccles Church, and other Suffolk Antiquities, folio, 10 plates, 1818.

77. Ducarel.

Antiquités Anglo-Normandes, par A. L. Léchaudé d'Anisy, imperial 8vo. 42 plates. Caen, 1823.

78. Gutensohn, J. G. von, and J. M. Knapp.

Deukmale der Christlichen Religion. The Antiquities, with plates, sections, views, and details of Christian Architecture of Continental Churches, large folio, Stutgard, 1827-30. The text in German, the plates very neatly executed in outline.

79. Halfpenny, J.

Gothic Ornaments in the Cathedral Church of York, 4to. 105 plates, 1795.

Fragmenta Vetusta, or Remains of ancient Buildings in York, royal 4to, 34 plates, 1807.

80. **Hall, Sir J.**

Essay on the Origin, History, and Principles of Gothic Architecture, 4to. 1813, 59 plates.

81. **Hawkins, J. S.**

Origin and Progress of Gothic Architecture, 8vo.

82. **Hunt, T. F.**

Examples of Tudor Architecture, adapted to modern Habitations; with illustrative Details selected from ancient Edifices, and Observations on the Furniture of the Tudor period, 4to. 37 plates, 1830.

83. **Jolimont, F. T. de.**

Monumens les plus remarquables de la Ville du Rouen, large folio, Paris, 1822, 30 plates.

84. **King, E.**

Munimenta Antiqua, or Observations on ancient Castles, including Remarks on the whole Progress of Architecture in Great Britain, folio, 4 volumes, 1799.

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Vetusta Monumenta, published by the Antiquarian Society, 6 vols. large folio, with numerous fine plates.

Architectural Notes on German Churches, with remarks on the origin of Gothic Architecture, Cambridge, 8vo., 1830.

Essays on Gothic Architecture, by Warton, Bentham, Grose, and Milner, royal 8vo., plates, 1800.

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APPENDIX, No. III.

BRIEF HEADS OF JURISPRUDENCE, AS FAR AS IT IS CONNECTED WITH ARCHITECTURE.

1. To *Abate*, from the French word *abattre*, to throw down, in old law, is the prostration, pulling down, or destroying of houses, by the tenant, (or usufructuary,) to the damage of the proprietor. The phrase was *abattre maison*, and the punishment was the same as for committing *waste*.
2. *Accessorial buildings*, are minor structures in addition to the principal building: they belong sometimes to the freeholder, sometimes to the landlord, sometimes to the tenant. Lord-chancellor Hardwicke, in a case judged in 1743, says, "To be sure, in the old cases, they go a great way upon the annexation to the freehold; and so long ago as Henry the Seventh's time, the courts of law construed even a copper and furnaces to be part of the freehold. Since that time, the general ground the court have gone upon, of relaxing this strict construction of law, is, that it is for the benefit of the public to encourage tenants for life to do what is advantageous to the estate during their term." All buildings were reckoned, among the Romans, to be accessories to the soil. Accessories to the buildings, were all such landlord's fixtures as could not be removed by the tenant.
3. *Adjunction*, is the building on another man's soil, fitting up another man's house, &c.; and it is an ancient legal maxim, that whatever is adjoined to a principal, becomes part of that principal, (si quis in alieno solo ex sua materia domum ædificaverit, illius fit domus, cujus et solum est.—Justic. Inst. lib. ii. tit. 1. § 30.) The houses in Bedford square, for instance, are adjunctive to the freehold of the duke of Bedford, and will become the property of the duke, at the expiration of the building leases. Adjunctions to houses already built, in the shape of finishings, &c., become part of the house. Fixtures may, under certain circumstances, be removed; but adjunctions to houses can in no case be removed, without incurring the penalties of trespass *de bonis asportatis*.

A tenant who erects any buildings of brick and mortar, and tiled, and slated, and let into the ground, at his own expense, on a *farm*, cannot remove them, even though it be during his term, and must leave the premises in the same state as when he entered. But they may be removed, if built upon blocks, rollers, or pattens. See the rule established by lord Ellenborough, in the case of Elwes, v. Maw. (East's Reports, vol. iii. p. 38.)

4 *Alteration*, or *despoiling* of tenements, as of a shop into a house of residence, or vice versa, against the will of the landlord, as well as the commission or causing of waste, may be stopped by an injunction from the court of chancery. A lessee can be restrained from pulling down buildings, and can be compelled to put them in the same state in which he found them, if they have been suffered to run into decay.

5. *Ambry*, a corruption of almonry, the apartment where the arms, plate, vessels, utensils, and every thing necessary for house-keeping, are kept; or as a corruption for *aumonrey*, from the Latin *eleemosynaria*, a house adjoining to an abbey, where alms are laid up for the poor.

6. *Ancient demesne*, (vetus patrimonium domini,) the title by which all manors belonging to the crown were held, under Edward the Confessor, and William the Conqueror.

7. *Annealing of tile*, from the Saxon *onælan*, to treat a thing so as to give it a true temper, a term signifying the turning or hardening of tiles, often used in old statutes, and still in force. By the 17th Edward IV. § 3, the justices of peace, on information that such annealing has not being done to the tiles, shall cause the tiles to be forfeited.

8. *Annexation*, relates to such permanent fixtures, chattels, &c., as cannot be legally removed from a house, and the annexer cannot remove it without being liable to damages. But buildings may be so constructed, that they shall not be considered as annexed, and therefore appertaining to the freehold. For, unless they be absolutely annexed to the principal by nails, bolts, mortar, or the like, they will be considered as mere loose and moveable chattels. See Taunt. vol. i. p. 19, Barnew. and Ald. vol. ii. p. 165.

9. *Appurtenances*, are inferior portions of a tenement, as out-houses, orchards, yards, and gardens, that appertain to the principal. One messuage cannot be appurtenant to another. A turbary may be appurtenant to a house, and a pew in a church; but the latter cannot be appurtenant to land, for the principal and appurtenant must agree in nature and quality.

10. *Aquage*, in old leases, &c. means a water-course, and in some cases toll paid for water-carriages.

11. *Archdeacons* and their officials are enjoined, by the provincial constitutions, to shew especial regard in surveying the state of repairs in churches, &c., particularly in respect of the chancel. By the statute of the 17 George III. c. 53, the archdeacon is to see to the repairs of parsonage houses, &c.

12. *Architects*, are answerable in law for ignorance. By the Roman laws, they and their heirs were answerable for their works for the space of fifteen years. Architects have generally been renumerated for their services by a commission of five per cent on the sum laid

out, as a *quantum meruit*. See the case of Upsdell, v. Stewart, in 1793, (Peake, p. 193.) On the architects to the crown, see the acts of 34 George III. 48 George III. 52 George III., and 54 George III.

13. *Astrum*, in old law, a house or place of habitation. Stat. of 18 Edward I.
14. *Attegia*, in old law, is a small house.
15. *Barton*, in old law means a manor-house. In the stat. of 2 and 3 Edward VI. c. 12, barton lands and demesne lands are synonymous. The word is used provincially in Devonshire for a manor-house, and in some places for outhouses.
16. *Batitoria*, in law Latin, are fulling mills.
17. The power of erecting *Beacons* is vested in the office of the lord high admiral, and, by the stat. of the 8 of Eliz. c. 13, in the corporation of Trinity house.
18. *Benches*, when affixed to the house, cannot be removed without trespass of waste: chimney pieces, pumps, &c., follow the same rule.
19. Dr. Wood, *Bishop* of Litchfield and Coventry in 1637, was suspended by archbishop Sancroft, for committing waste, and suffering dilapidations to his palace, and other ecclesiastical buildings. The profits of his bishopric were sequestered, and the palace rebuilt out of them.
20. *Bow windows*, are regulated by the building act of the statute of 16 George III. c. 78. § 43.
21. *Brewery* buildings, are generally liable to the same law as agricultural buildings: lord Ellenborough, in the case of Elwes, v. Maw, said, that a building which is accessible to a removeable utensil, is equally removeable with the thing to which it is incident. See the judgment of lord Hardwicke, in Blackst. Rep. vol. i. p. 259. n. Atk. vol. iii. p. 16. n.
22. Stoves set in *Brickwork* may be removed by the tenant.
23. *Bridges*. The inhabitants of a county are liable to the repair of public bridges, and also to the repair of the highway to the extent of three hundred feet at each end of the bridge. An allowance to the surveyors of bridges is to be made by the justices of the place where the bridge is situated. By 43 George III. c. 59. § 1., surveyors of bridges and other public works, appointed by the justices at quarter sessions, may search for, take, and carry away gravel, stone, sand, and other materials, for the repair of such bridges, &c. as the county are bound to repair. By 55 George III. c. 143. § 1. they may, by the order of two acting justices of the county, &c., search for, dig, get, and carry away, any stone from any quarry within such county, (except quarries within a garden, yard, avenue to a house, lawn, park, paddock, or enclosed plantation, which has or may have ornamental timber growing thereon,) without leave of the owner, and making proper satisfaction. See also the statute of 43 George III. c. 39. § 3—5.
24. *Brig-bote*, in Anglo-Saxon law, was the contribution to the repairs of bridges.
25. *Building act*; see the art. *Bricklayer*, in the dictionary.

26. Justices of the peace, by 12 George III. c. 29, and 13 George III. c. 18, are to see the repair of public buildings.

27. *Buildings erected by tenants.* If a person take the lease of a house and land, and covenants to have the demised premises in good repair at the end of the term, and he erects a tenement upon part of the land, in addition to those which were there before, he must keep and leave it in good repair also. A tenant having a right to remove erections, may do it after the expiration of his lease. Buildings which are let into the soil, or otherwise fixed to the freehold, are termed *estate buildings.* From various decisions, it is clear, that a covenant entered into by a tenant to yield up in repair, at the expiration of his lease, all buildings which should be erected during the term, upon the demised premises, includes all buildings erected and used by the tenant for any purpose, if such building be let into the soil, or otherwise affixed to the freehold, but not when they rest upon blocks, pattens, or piers.

28. *Burghbote,* in ancient law, a tribute towards the building or repairing the castles or walls of a borough or city.

29. *Canons, constitutions,* and *injunctions* relating to ecclesiastical buildings. By the canon of archbishop Edmund, made in 1234, 18 Henry III., if the rector of a church leave the houses of the church, (such as the manse of the rectory or vicarage, and other edifices, of which the building and repairing belongs to the incumbent,) ruinous and decayed, the expenses of the repair shall be deducted out of his ecclesiastical goods. By a canon of archbishop Stratford, archdeacons, and other ordinaries, in their visitations, may command to be repaired under pecuniary penalties, any defects in the church, or its ornaments, or in the fences of the church-yard, or in the houses of the incumbents. Custom, that is, common law, however, requires that the nave, at least, of the church be repaired by the parishioners, and sometimes the chancel. By the constitution of Otho, none may pull down ancient churches, without leave of the diocesan. By the canons of 1603, (1 James I.,) the churchwardens are bound to see that the church, except the chancels, be kept in good repair. Archdeacons are to survey churches every three years, and certify defects to the high commissioners. The chancel, &c., is to be repaired by the incumbent, or by others to whom the repairs may belong. The parson is bound to repair the chancel. The chancel may not be altered, (5 and 6 Edward VI. and 13 and 14 Car. II.) Lay impropriators are also to repair the chancel. (Mod. Rep. P. i. p. 250, P. ii. p. 254.) Repairing the chancel is a discharge from contributing to the repairs of the church. The statute of 35 Edward I. c. 4, (1307,) with respect to trees growing in church-yards, says, "We do prohibit the parsons of the church, that they do not presume to sell them unavoidably, but when the chancel of the church doth want necessary reparations. Neither shall they be converted to any other use, except the body of the church doth need like repair. In which case, the parsons, of their charity, shall do well to relieve the parishioners with bestowing upon them the same trees; which we will not command to be done, but we will commend it when it is done."

The 13 Eliz. c. 10., forbids the grant of ecclesiastical possessions for a lease of more than twenty-one years. Dilapidations to be judged only by credible persons on oath, and repaired according to the diocesan. Executors must make satisfaction for dilapidations before the payment of any legacies. See the 13 Eliz. c. 10.

30. Lord Coke, says, that no subject can build a *Castle*, or house of strength, embattled, &c. or other fortress defensible, called in law by the names *castellum*, *castrum*, *domus defensibilis*, and *mansus muralis*, and sometimes *domus kernellatæ* or *carnellatæ*, *tenellatæ*, *machicollatæ*, *mese carnelet*, *mansus carnellatus*, fortified hall or mansion, &c., without the license of the king.

31. *Carnellatus*, or kernellatus, in law, signifies fortified: *tenellatæ*, having loop-holes in the walls to shoot arrows from.

32. Churchwardens, though not charged with the repairs of the *Chancel*, are charged with seeing that it is not permitted to fall into decay.

33. *Chimney-pieces*, if put up by the tenant, become, by the rule of law, the property of the landlord. But in the case of Allen v. Allen, it is admitted, that marble chimney-pieces and glasses are ornaments that may be taken down. In the case of Lawton v. Lawton, lord Hardwicke said, "What would have been held to be waste in Henry the Seventh's time, as removing wainscot fixed on by screws, and marble chimney-pieces, is now allowed to be done."

34. *Cider mills* erected by tenants, and let into the ground, are removeable, as they are included in the exceptions relating to trading erections.

35. Detached pipes and *Conduits* that supply houses with water, belong to the freehold.

36. *Conservatories*, green-houses, hot-houses, &c., put up by gardeners and nursery-men, though built of wood on foundations of brick, may be taken away, as being for the purpose of carrying on trade, according to lord Kenyon. Lord Ellenborough decided that they were not removeable. (See East's Rep. vol. ii. p. 66 and 91.)

37. When a builder *Contracts* for a certain sum, and additions are made to the original plan, the contract remains binding as far as it can be traced, and the excess only is recoverable on a *quantum meruit*.

38. *Copyhold estate.* The estate of the copyholder is not merely at the will of the lord, but at the will of the lord according to the custom of the manor. A copyholder may pull down ruinous houses to rebuild others.

39. *Curates*, at will, are not liable to dilapidations.

40. *Disinherison*, is the injury done to an estate, by suffering the tenements thereon to go to ruin, dilapidation, or waste.

41. *Doors*, are considered, in law, as belonging to the freehold: as are also *dressers*, if affixed to the wall or floor.

42. In the case of Kimpton, v Eve, it was decided to be waste to destroy a *dove-cote*.

43. *Dutch-barns*, a shed building with a foundation of brick, and uprights fixed in to support the roof, which is covered with tiles, and the sides open, are removeable.

44. *Glass*, used in windows, is parcel of the freehold, and breaking or carrying it away is waste.

45. *Haga*, in ancient records, means a house or dwelling. In an ancient plea concerning Faversham in Kent, *hawes* are interpreted to mean mansions.

46. The *Incidents* of a house, are glass, doors, wainscot, and the like, and belong to the freehold.

47. The word *Land*, includes the surface of the earth, and all that is under it, or over it; and when a person grants all his lands, he grants all his mines of metals or fossils, his woods, his waters, and his houses, as well as his fields and meadows. No man may erect any building to overhang the land of another man.

48. *Land-gabel*, in Doomsday book, was a rent rising out of land or tenement, a penny for every house, according to Spelman.

49. *Monuments*, in churches, belong to the heir in the manner of heirlooms, and may not be taken by the parson.

50. A *Mortgage* in possession, may pull down ruinous houses, and build up others on their site, but he must not commit dilapidations or waste. He is bound to keep the buildings mortgaged to him in necessary repair, and he will be allowed the charge of permanent improvements.

51. The *Occupier* of a house must fence in a dangerous area, though it has remained open from time immemorial, or he is answerable for his negligence.

52. Lord Coke says, "If a man has a house near to my house, and he suffereth his house to become so ruinous as it is like to fall on my house, I may have a writ *de domo reparandâ*, to compel him to repair his house.

53. The laws relating to *Party-walls*, are principally to be found in the building act.

54. Tenantable *Repairs*, are such as relate only to the finishing and ornamenting of tenements. The case of Ferguson, v. ......, was an action to recover damages for suffering a house of the plaintiff to be out of repair. "The defendant had rented a house of the plaintiff, as tenant at will, at £81 per annum. On quitting it, the house was found to be much out of repair, and the plaintiff had it surveyed, and an estimate made of the sum necessary to put it into *complete*, instead of *tenantable* repair; and for this account he brought an action. Lord Kenyon said, "that the plaintiff was not to be permitted to go for the damages so claimed; for a tenant from year to year is bound to commit no waste, and to make fair and tenantable repairs, such as putting in windows and doors that have been broken by him, so as to prevent waste and decay of the premises; but, in the present case, the plaintiff has claimed a sum for putting on a new roof, on an old worn-out house: this his lordship thought a tenant not bound to do, and that the plaintiff had no title to recover."

55. *Waste*. If a house be uncovered when a tenant takes possession, it is no waste in him to suffer it fall down: but if he pull it down, it is waste, unless he build it up again. Converting one chamber into two, or two into one, or converting a hand-mill into a horse-mill, is waste. If a tenant build a new house, it is committing waste

upon the estate; and if he suffer it to be wasted when built, it is a new waste. If a tenant repair a house which he has suffered to waste, with timber felled on the estate without leave, it is double waste. Digging any quarries or mines, and appropriating the materials, if they were not open when the tenant came in, is waste. A tenant of a house, which was ruinous at the time of leasing, is not punishable if it fall. Improvements without leave are waste.

56. Twenty years' enjoyment of *Windows* give a right, and no one may obstruct them. But if they be stopped up for twenty years, the right is lost. When the window is darkened by a wall, and it is in a malt-house, or other manufactory, and the light admitted is still sufficient to serve the original purpose, an action cannot be maintained.

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END OF VOL. II.

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